Definitive Interconnection System Impact Study for Generation Interconnection Requests

(DISIS-2015-002-4)

Group 2, 6, 8 &16 Restudy

November 2017

Generator Interconnection

Revision History

Date	Author	Change Description
2/5/2016	SPP	Draft issued to Transmission Owners for review
2/12/2016	SPP	Report Issued (DISIS-2015-002). Some stability analysis still pending. Group 2, 6, 7, 15 and 16 Interconnection Request Results not included in this issue.
2/22/2016	SPP	Draft issued to Transmission Owners for Group 2, 6, and 7 review
2/29/2016	SPP	Report Issued (DISIS-2015-002) to include Group 2, 6, and 7 Results. Some stability analysis still pending. 15 and 16 Interconnection Request Results not included in this issue.
3/17/2016	SPP	Draft issued to Transmission Owners for Group 15, and 16 review
3/29/2016	SPP	Report Issued (DISIS-2015-002) to include Group 15 and 16 Results. Group 16 stability analysis still pending.
4/28/2016	SPP	Report Issued to include Group 16 stability analysis
8/01/2016	SPP	ReStudy to account for withdrawn projects.
8/04/2016	SPP	DISIS-2015-002-1 reposted for AECI Affected System Cost Allocation correction and update to Introduction Section Stand-Alone Language
11/29/2016	SPP	Restudy Power Flow Analysis for Group 1 only. Cost Allocation for all projects. To account for withdrawn Projects, Report Reposted (DISIS-2015-002-2)
7/10/2017	SPP	Restudy Power Flow Analysis for Group 1 only to account for withdrawn projects GEN-2011-051, GEN-2015-060, and GEN-2015-081. Report Reposted (DISIS-2015-002-3)
9/22/2017	SPP	Restudy Analysis for Group 8 only to account for withdrawn projects GEN-2015-067. Report Reposted (DISIS-2015-002-4). Groups 2, 6, and 16 results to be posted once at a later date.
11/2/2017	SPP	Report Issued to include Groups 2, 6, and 16 restudy analysis. Additionally latest cost estimate for GEN-2015-063 Tap – Mathewson 345kV upgrade are included for the allocated Group 8 request.

Executive Summary

Pursuant to the Generator Interconnection Procedures (GIP) of the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this Definitive Interconnection System Impact Study (DISIS). The Interconnection Customers' requests have been clustered together for the following DISIS window which closed September 30, 2015. The Interconnection Customers will be referred to in this study as the DISIS-2015-002 Interconnection Customers. This DISIS analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling approximately 6,176.9 MW of new generation which would be located within the transmission systems of American Electric Power – Western (AEPW), Basin Electric Power Cooperative (BEPC), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Southwestern Power Administration (SWPA), Sunflower Electric Power Corporation\Mid-Kansas Electric Company, LLC (SUNC\MKEC), Western Area Power Administration (WAPA), Westar Energy, Inc. (WERE), and Western Farmers Electric Cooperative (WFEC). The various generation interconnection requests have differing proposed in-service dates[1]. The generation interconnection requests included in this DISIS are listed in Appendix A by their queue number, amount, requested interconnection service, area, requested interconnection point, proposed interconnection point, and the requested in-service date. This study represents the "Stand-Alone" analysis for remaining Interconnection Requests in the DISIS-2015-002 analysis.

Power flow analysis has indicated that for the power flow cases studied, 6,176.9 MW of nameplate generation may be interconnected with transmission system reinforcements within the SPP transmission system. For the analyses that has been completed, dynamic stability and power factor analysis has determined the need for reactive compensation in accordance with SPP stability and voltage recovery requirements including FERC Order #661-A for wind farm interconnection requests. Those reactive requirements are listed for each interconnection request within this report. Dynamic stability analysis has determined that the transmission system will remain stable with the assigned Network Upgrades and necessary reactive compensation requirements. A short circuit analysis has been performed with available short circuit values given in the stability study for each group in the appendices of this report.

In no way does this study guarantee operation for all periods of time. This interconnection study identifies and assigns transmission reinforcements for Energy Resource Interconnection Service (ERIS) interconnection injection constraints (defined as a 20% or greater distribution factor impact for outage based constraints and 3% or greater distribution factor impact for system intact constraints) and Network Resource Interconnection Service (NRIS) constraints (defined as 3% or greater distribution factor impact), if requested by the Customer. These constraints are listed in Appendix G-T (Thermal) and Appendix G-V (Voltage). This interconnection study does not assign

[1] The generation interconnection requests in-service dates may need to be deferred based on the required lead time for the Network Upgrades necessary. The Interconnection Customers that proceed to the Interconnection Facilities Study will be provided a new in-service date based on the Facility Study's time for completion of the Network Upgrades necessary or as otherwise provided for in the GIP.

transmission reinforcements for all potential transmission constraints. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Interconnection Customer(s) may be required to reduce their generation output to 0 MW (also known as curtailment) under certain system conditions to allow system operators to maintain the reliability of the transmission network.

The total minimum cost for interconnecting the DISIS-2015-002 Interconnection Customers is estimated at $512,614,058 for Group 2, 6, 8, and 16 Interconnection Customers only. The total DISIS-2015-002 cost estimate for all Interconnection Customers will be provided once all groups in DISIS-2015-002-4 are studied. The following costs are not included in this total –

- **Costs Not Included** – Costs on Affected Systems, namely Associated Electric Cooperative Inc. (AECI) or Mid-Continent Independent System Operator (MISO).

The costs determined at this time are shown in Appendix E and F. For Interconnection Requests that result in an interconnection or modification to the transmission facilities of the Western-UGP (WAPA), a National Environmental Policy Act (NEPA) Environmental Review will be required. The Interconnection Customer will be required to execute and Environmental Review Agreement per Section 8.6.1 of the GIP.

Interconnection Service to DISIS-2015-002 Interconnection Customers is also contingent upon higher queued customers paying for certain required network upgrades. **The in-service date for the DISIS customers will be deferred until the construction of these network upgrades can be completed.** Costs in Appendix E and F do not include the Interconnection Customer Interconnection Facilities as defined by the SPP Open Access Transmission Tariff (OATT) or the additional SPP transmission network constraints identified through this study and listed in Appendix H.

Constraints identified in Appendix H do not require transmission reinforcement for Interconnection Service, but could require the Interconnection Customer to reduce their generation in operational conditions. These transmission constraints occur when this study's generation is dispatched into the SPP footprint for ERIS or when this study's generation is dispatched into the interconnecting Transmission Owner's (T.O.) area for NRIS.

It should be noted that the additional network constraints identified in Appendix H may also be identified by a Transmission Service Request (TSR) and may need to be verified by associated studies. With a defined source and sink in a TSR, the list of network constraints will be refined and expanded to account for all Network Upgrade requirements. The required interconnection costs listed in Appendix E and F do not include costs associated with the deliverability of the energy to load or other customers. These costs are determined by separate studies should the Customer decide to submit a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. Furthermore, this DISIS does not guarantee either transmission service or deliverability of the requested resource.

When applicable, affected system thermal and voltage constraints are listed in Appendix H-T-AS and Appendix H-V-AS. Affected System constraints could require an affected system impact study review by the affected party or affected system parties. The affected system impact study could identify additional transmission reinforcement upgrades required for interconnection.

NERC FAC-002-2 Compliance Statement

As a Planning Coordinator, SPP has studied the reliability impact of interconnecting new or materially modified generation requesting interconnection to the SPP Transmission System and any affected systems as requested by those entities. Affected systems include both the systems of SPP Transmission Owners and systems not included in the SPP Tariff footprint. The impact of the generation interconnection on affected systems will be further coordinated with the following systems as part of the coordinated planning procedures as described in Section 6 of this report and summarized below.

- Impacts on Associated Electric Cooperative Inc. (AECI) – AECI has completed their review and analysis for requests impacting the AECI system
- Impacts on Mid Continent Independent System Operation (MISO) – MISO has been contacted and provided a list of interconnection requests that proceed to move forward into the Interconnection Facilities Study Queue. MISO is evaluating the Interconnection Requests for impacts.
- Impacts on Minnkota Power Cooperative, Inc (MPC) – MPC has completed their review and did not identify an impact to the MPC

This analysis adheres to NERC standards, regional, and Transmission Owner planning criteria, as related to generator interconnections. Facility interconnection requirements will be fully evaluated by the Transmission Owners during the Interconnection Facilities Study.

This analysis evaluates steady-state (Section 8), short-circuit (Section 9), and dynamic studies (Section 9) to evaluate system performance under both normal and contingency conditions. Study assumptions (Section 2) and system performance (Section 3) are documented in this report. Alternatives considered and coordinated recommendations are documented in Section 8 and Section 9.

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1 Introduction

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this DISIS for certain generation interconnection requests in the SPP Generation Interconnection Queue. These interconnection requests have been clustered together for the following DISIS window which closed September 30, 2015. The customers will be referred to in this study as the DISIS-2015-002 Interconnection Customers. This DISIS analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling 6,176.9 MW of new generation which would be located within the transmission systems of American Electric Power – Western (AEPW), Basin Electric Power Cooperative (BEPC), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Southwestern Power Administration (SWPA), Sunflower Electric Power Corporation\Mid-Kansas Electric Company, LLC (SUNC\MKEC), Western Area Power Administration (WAPA), Westar Energy, Inc. (WERE), and Western Farmers Electric Cooperative (WFEC). The various generation interconnection requests have differing proposed in-service dates[2]. The generation interconnection requests included in this DISIS are listed in Appendix A by their queue number, amount, requested interconnection service, area, requested interconnection point, proposed interconnection point, and the requested in-service date. This study represents the "Stand-Alone" analysis for remaining Interconnection Requests in the DISIS-2015-002 analysis.

The primary objective of this DISIS is to identify the system constraints, transient instabilities, and over-dutied equipment associated with connecting the generation to the area transmission system. The Impact Study and other subsequent Interconnection Studies are designed to identify required Transmission Owner Interconnection Facilities, Network Upgrades and other Direct Assignment Facilities needed to inject power into the grid at each specific point of interconnection.

[2] The generation interconnection requests in-service dates may need to be deferred based on the required lead time for the Network Upgrades necessary. The Interconnection Customers that proceed to the Facility Study will be provided a new in-service date based on the completion of the Facility Study or as otherwise provided for in the GIP.

2 Model Development (Study Assumptions)

2.1.1 Interconnection Requests Included in the Cluster

SPP included all interconnection requests that submitted a DISIS Agreement no later than September 30, 2015 and were subsequently accepted by Southwest Power Pool under the terms of the Generator Interconnection Procedures (GIP) that were in effect at the time this study commenced on October 1, 2015. The interconnection requests that are included in this study are listed in Appendix A.

2.1.2 Affected System Interconnection Request

Also included in this DISIS is one (1) Affected System Study. The Affected System Interconnection Requests have been given the designations with the "ASGI" prefix. These requests are listed in Appendix A. Affected System Interconnection Requests were only studied in "cluster" scenarios.

2.1.3 Previously Queued Interconnection Requests

The previous queued requests included in this study are listed in Appendix B. In addition to the Base Case Upgrades, the previous queued requests and associated upgrades were assumed to be in-service and added to the Base Case models. These projects were dispatched as ERIS with equal distribution across the SPP footprint. Prior queued projects that requested NRIS were also dispatched in separate NRIS scenarios into the balancing authority of the interconnecting transmission owner.

2.2 Development of Base Cases

2.2.1 Power Flow

The 2015 series Integrated Transmission Planning models (used in the 2016 ITPNT) including the 2016 winter peak (16WP) season, the 2017 spring (17G) and 2017 summer peak (17SP) seasons, the 2020 light load (20L), summer (20SP) and winter peak (20WP) seasons, and the 2025 summer peak (25SP) season were the starting seasonal models for this study.

2.2.2 Dynamic Stability

The 2015 series SPP Model Development Working Group (MDWG) Models for 2016 winter peak (16WP) season, 2017 summer peak (17SP) season, and the 2025 summer peak (25SP) season cases were used as starting points for this study.

2.2.3 Short Circuit

The 2017 and 2025 summer peak stability cases are used for this analysis.

2.2.4 Base Case Upgrades

The following facilities are part of the SPP Transmission Expansion Plan, the Balanced Portfolio or recently approved Priority Projects. These facilities have an approved Notification to Construct (NTC) or are in construction stages and were assumed to be in-service at the time of dispatch and added to the base case models. The DISIS-2015-002 Interconnection Customers have not been assigned advancement costs for the below listed projects. <u>The DISIS-2015-002 Interconnection Customers Generation Facilities in service dates may need to be delayed until the completion of the following upgrades.</u> <u>In some cases, the in-service date is beyond the allowable time a customer can delay. In this case, the Interconnection Customer may move forward with Limited Operation or remain in the</u>

DISIS Queue for additional study cycles. If for some reason, construction on these projects is discontinued, additional restudies will be needed to determine the interconnection needs of the DISIS Interconnection Customers.

- 2012 Integrated Transmission Plan (2012 ITP10) Projects
  - Woodward-Tatonga-Mathewson-Cimarron 345kV transmission line circuit #2, scheduled for 2018 in-service[3]
  - Chisholm – Gracemont 345kV transmission line, and Chisholm 345/230kV transformer circuit #1, scheduled for 3/1/2018 in-service[4]
- 2015 Integrated Transmission Plan Near Term (2015 ITPNT) Projects
  - Potash Junction – Intrepid – IMC #1 – Livingston Ridge 115kV rebuild
  - National Enrichment Plant – Targa – Cardinal 115kV circuit #1 rebuild
- Gentleman – Thedford (Cherry County) – Holt County 345kV circuit #1 scheduled for 2019 in-service[5]
- Hoskins – Neligh East 345/115 kV Project, placed in-service in 2017[6]
  - Neligh East 345/115 kV substation and transformer
  - Neligh East Area 115 kV upgrades to support new station
  - Hoskins – Neligh East 345 kV circuit #1
- High Priority Incremental Loads (HPILs) Projects[7]:
  - TUCO Interchange – Yoakum – Hobbs Interchange 345/230 kV Project
    - TUCO Interchange – Yoakum – Hobbs Interchange 345 kV circuit #1 and associated terminal equipment upgrades
    - Hobbs 345/230/13 kV transformer circuit #1
    - Yoakum 345/230/13 kV transformer circuit #1
  - Chaves County – Price – CV Pines – Capitan 115 kV circuit #1
  - China Draw – Yeso Hills 115 kV circuit #1
  - Dollarhide – Toboso Flats 115 kV circuit #1
  - Hobbs Interchange – Kiowa 345 kV circuit #1
  - Kiowa – North Loving – China Draw 345/115 kV Projects
    - Kiowa – North Loving – China Draw circuit #1 and associated terminal equipment upgrades
    - China Draw 345/115/13 kV transformer circuit #1
    - North Loving 345/115/13 kV transformer circuit #1
  - Kiowa – Road Runner 345/230/115 kV Projects
    - Kiowa 345/230 kV transformer circuit #1
    - Road Runner 345/115/13 kV transformer circuit #1
  - Livingston Ridge – Sage Brush – Lagarto – Cardinal 115 kV circuit #1

[3] SPP Notification to Construct (NTC) 200223
[4] SPP Notification to Construct (NTC) 200240 and 200255
[5] SPP Notification to Construct (NTC) 200220
[6] SPP Regional Reliability 2012 ITP 10 Project Per SPP-NTC-200220
[7] Per Network Upgrades assigned in High Priority Incremental Loads (HPILs) study, Including Direct Assigned Upgrades, Projects in SPP-NTC-200256 and SPP-NTC-200283.

  - North Loving – South Loving 115 kV circuit #1
  - Ponderosa – Ponderosa Tap 115 kV circuit #1
- Nebraska City – Mullin Creek – Sibley 345kV circuit #1 build, place in-service in 2016[8]

2.2.5 Contingent Upgrades

The following facilities do not yet have approval. These facilities have been assigned to higher queued interconnection customers. These facilities have been included in the models for the DISIS-2015-002 study and are assumed to be in service. This list may not be all inclusive. <u>The DISIS-2015-002 Interconnection Customers, at this time, do not have responsibility for these facilities but may later be assigned the cost of these facilities if higher queued customers terminate their Generation Interconnection Agreement or withdraw from the interconnection queue. The DISIS-2015-002 Interconnection Customer Generation Facilities in-service dates may need to be delayed until the completion of the following upgrades.</u>

- Upgrades assigned to DISIS-2010-002 Interconnection Customers:
  - Twin Church – Dixon County 230 kV circuit #1 rerate (320 MVA).
  - Buckner – Spearville 345 kV circuit #1 terminal equipment.
- Upgrades assigned to DISIS-2011-001 Interconnection Customers:
  - Hoskins – Dixon County – Twin Church 230 kV circuit #1 conductor clearance increase.
  - (NRIS only) Woodward District EHV Phase Shifting Transformer, placed in-service in 2017.
- Upgrades assigned to DISIS-2012-002 Interconnection Customers:
  - Lake Creek – Lone Wolf 69 kV circuit #1 reset CT, placed in-service in 2016
- Upgrades assigned to DISIS-2013-002 Interconnection Customers:
  - Battle Creek – County Line – Neligh East 115kV circuit #1 rebuild, in-service in 2017.
- Upgrades assigned to DISIS-2014-002 Interconnection Customers:
  - Tolk – Plant X 230kV circuit #1 and circuit #2, re-conductor.
  - Tuco 345/230kV transformer replacement.
- Upgrades assigned to DISIS-2015-001 Interconnection Customers:
  - Cimarron River Tap – Kismet – Cudahy – Crooked Creek 115kV circuit #1 rebuild.
  - Oklaunion 345kV Reactive Power Support
    - Install 50 Mvar Capacitor Bank(s).
  - (NRIS Only) Renfrow – Renfrow 138kV circuit #1 rebuild.
  - (NRIS Only) Sundown Interchange 230/115/13.8kV transformer circuit #1 replacement.
    - Build 345/230/13kV transformer
  - (NRIS Only) Wolfforth Interchange 230/225/13.2kV circuit #1 replacement.

2.2.6 Potential Upgrades Not in the Base Case

Any potential upgrades that do not have a Notification to Construct (NTC) and are not explicitly listed within this report have not been included in the base case. These upgrades include any identified in the SPP Extra-High Voltage (EHV) overlay plan, or any other SPP planning study other than the upgrades listed above in the previous section.

[8] SPP Notification to Construct (NTC) 20097 and 20098

2.2.7 Regional Groupings

The interconnection requests listed in Appendix A are grouped together into ten (10) active regional groups based on geographical and electrical impacts. These groupings are shown in Appendix C.

To determine interconnection impacts, ten (10) different generation dispatch scenarios of the spring, summer, and winter base case models are developed to accommodate the regional groupings.

2.3 Development of Analysis Cases

2.3.1 Power Flow

For Variable Energy Resources (VER) (solar/wind) in each power flow case, ERIS, is evaluated for the generating plants within a geographical area of the interconnection request(s) for the VERs dispatched at 100% nameplate of maximum generation. The VERs in the remote areas are dispatched at 20% nameplate of maximum generation. These projects are dispatched across the SPP footprint using load factor ratios.

Peaking units are not dispatched in the 2017 spring, 2020 light, or in the “High VER” summer and winter peaks. To study peaking units’ impacts, the 2016 winter peak and 2017 summer peak, 2020 summer and winter peaks, and 2025 summer peak models are developed with peaking units dispatched at 100% of the nameplate rating and VERs dispatched at 20% of the nameplate rating. Each interconnection request is also modeled separately at 100% nameplate for certain analyses.

All generators (VER and peaking) that requested NRIS are dispatched in an additional analysis into the interconnecting Transmission Owner’s (T.O.) area at 100% nameplate with ERIS only requests at 80% nameplate. This method allows for identification of network constraints that are common between regional groupings to have affecting requests share the mitigating upgrade costs throughout the cluster.

2.3.1.1 Additional Sensitivities Considered – The following sensitivities were run for situations prevalent to the local area for which they were considered

- North Dakota – Canadian border – The phase shifting transformer to Saskatchewan Power (also known as B-10T) and Miles City DC Tie were dispatched at the following levels
    - 2016 Winter Peak –
        - Miles City DC Tie– 200MW East to West transfer
        - B-10T – 65MW South to North transfer
    - 2017 Summer Peak –
        - Miles City DC Tie – 200MW East to West transfer
        - B-10T – 200MW North to South transfer
    - Other Seasons
        - Miles City DC Tie – 140MW East to West transfer (20WP)
        - Miles City DC Ties – 92MW East to West transfer (17G & 20L)
        - B-10T – 0MW

2.3.2 Dynamic Stability

For each group, all interconnection requests are dispatched at 100% nameplate output while the other groups are dispatched at 20% output for VERs and 100% output for thermal requests.

2.3.2.1 Additional Sensitivities Considered

- North Dakota – Canadian border – The phase shifting transformer to Saskatchewan Power (also known as B-10T) and Miles City DC Tie were dispatched at the following levels
    - 2016 Winter Peak –
        - Miles City DC Tie– 200MW East to West transfer
        - B-10T – 65MW South to North transfer
    - 2017 Summer Peak –
        - Miles City DC Tie – 200MW East to West transfer
        - B-10T – 200MW North to South transfer

2.3.3 Short Circuit

The dynamic stability models (2017 SP and 2025 SP) are used for this analysis.

3 Identification of Network Constraints (System Performance)

3.1.1 Thermal Overloads

Network constraints are found by using PSS/E AC Contingency Calculation (ACCC) analysis with PSS/E MUST First Contingency Incremental Transfer Capability (FCITC) analysis on the entire cluster grouping dispatched at the various levels previously mentioned.

For ERIS, thermal overloads are determined for system intact (n-0) (greater than 100% of Rate A - normal) and for contingency (n-1) (greater than 100% of Rate B – emergency) conditions.

The overloads are then screened to determine which of generator interconnection requests have at least

- 3% Distribution Factor (DF) for system intact conditions (n-0),
- 20% DF upon outage based conditions (n-1),
- or 3% DF on contingent elements that resulted in a non-converged solution.

Appropriate transmission support is then determined to mitigate the constraints.

Interconnection Requests that requested NRIS are also studied in a separate NRIS analysis to determine if any constraint measured greater than or equal to a 3% DF. If so, these constraints are also considered for transmission reinforcement under NRIS.

3.1.2 Voltage

For non-converged power flow solutions that are determined to be caused by lack of voltage support, appropriate transmission support will be determined to mitigate the constraint.

After all thermal overload and voltage support mitigations are determined; a full ACCC analysis is then performed to determine voltage constraints. The following voltage performance guidelines are used in accordance with the Transmission Owner local planning criteria.

SPP Areas (69kV+):

Transmission Owner	Voltage Criteria (System Intact)	Voltage Criteria (Contingency)
AEPW	0.95 – 1.05 pu	0.92 – 1.05 pu
GRDA	0.95 – 1.05 pu	0.90 – 1.05 pu
SWPA	0.95 – 1.05 pu	0.90 – 1.05 pu
OKGE	0.95 – 1.05 pu	0.90 – 1.05 pu
OMPA	0.95 – 1.05 pu	0.90 – 1.05 pu
WFEC	0.95 – 1.05 pu	0.90 – 1.05 pu
SWPS	0.95 – 1.05 pu	0.90 – 1.05 pu
MIDW	0.95 – 1.05 pu	0.90 – 1.05 pu

SUNC	0.95 – 1.05 pu	0.90 – 1.05 pu
KCPL	0.95 – 1.05 pu	0.90 – 1.05 pu
INDN	0.95 – 1.05 pu	0.90 – 1.05 pu
SPRM	0.95 – 1.05 pu	0.90 – 1.05 pu
NPPD	0.95 – 1.05 pu	0.90 – 1.05 pu
WAPA	0.95 – 1.05 pu	0.90 – 1.05 pu
WERE L-V	0.95 – 1.05 pu	0.93 – 1.05 pu
WERE H-V	0.95 – 1.05 pu	0.95 – 1.05 pu
EMDE L-V	0.95 – 1.05 pu	0.90 – 1.05 pu
EMDE H-V	0.95 – 1.05 pu	0.92 – 1.05 pu
LES	0.95 – 1.05 pu	0.90 – 1.05 pu
OPPD	0.95 – 1.05 pu	0.90 – 1.05 pu

SPP Buses with more stringent voltage criteria:

Bus Name/Number	Voltage Criteria (System Intact)	Voltage Criteria (Contingency)
TUCO 230kV 525830	0.925 – 1.05 pu	0.925 – 1.05 pu
Wolf Creek 345 kV 532797	0.985 – 1.03 pu	0.985 – 1.03 pu
S1251646251	1.001 – 1.047 pu	1.001 – 1.047 pu

Affected System Areas (115kV+):

Transmission Owner	Voltage Criteria (System Intact)	Voltage Criteria (Contingency)
AECI	0.95 – 1.05 pu	0.90 – 1.05 pu
EES-EAI	0.95 – 1.05 pu	0.90 – 1.05 pu
LAGN	0.95 – 1.05 pu	0.90 – 1.05 pu
EES	0.95 – 1.05 pu	0.90 – 1.05 pu
AMMO	0.95 – 1.05 pu	0.90 – 1.05 pu
CLEC	0.95 – 1.05 pu	0.90 – 1.05 pu
LAFA	0.95 – 1.05 pu	0.90 – 1.05 pu
LEPA	0.95 – 1.05 pu	0.90 – 1.05 pu
XEL	0.95 – 1.05 pu	0.90 – 1.05 pu
MP	0.95 – 1.05 pu	0.90 – 1.05 pu
SMMPA	0.95 – 1.05 pu	0.90 – 1.05 pu
GRE	0.95 – 1.05 pu	0.90 – 1.10 pu
OTP	0.95 – 1.05 pu	0.90 – 1.05 pu
OTP-H (115kV+)	0.97 – 1.05 pu	0.92 – 1.10 pu
ALTW	0.95 – 1.05 pu	0.90 – 1.05 pu
MEC	0.95 – 1.05 pu	0.90 – 1.05 pu
MDU	0.95 – 1.05 pu	0.90 – 1.05 pu
SPC	0.95 – 1.05 pu	0.95 – 1.05 pu

DPC	0.95 – 1.05 pu	0.90 – 1.05 pu
ALTE	0.95 – 1.05 pu	0.90 – 1.05 pu

The constraints identified through the voltage scan are then screened for the following for each interconnection request. 1) 3% DF on the contingent element and 2) 2% change in pu voltage. In certain conditions, engineering judgement was used to determine whether or not a generator had impacts to voltage constraints.

3.1.3 Dynamic Stability

Stability issues considered for transmission reinforcement under ERIS. Generators that fail to meet low voltage ride-through requirements (FERC Order #661-A) or SPP's stability criteria for damping or dynamic voltage recovery are assigned upgrades such that these requirements can be met.

3.1.4 Upgrades Assigned

Thermal overloads that require transmission support to mitigate are discussed in Section 8 and listed in Appendix G-T. Voltage constraints that may require transmission support are discussed in Section 8 and listed in Appendix G-V (Cluster Analysis). Constraints that are identified solely through the stability analysis are discussed in Section 8 and the appropriate appendix for the detailed stability study of that Interconnection Request. All of these upgrades are cost assigned in Appendix E and Appendix F.

Other network constraints not requiring transmission reinforcements are shown in Appendix H (Cluster Analysis). With a defined source and sink in a Transmission Service Request, this list of network constraints can be refined and expanded to account for all Network Upgrade requirements for firm transmission service. Additional constraints identified by multi-element contingencies are listed in Appendix I.

In no way does the list of constraints in Appendix G (Cluster Analysis) identify all potential constraints that guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

4 Determination of Cost Allocated Network Upgrades

Cost Allocated Network Upgrades of Variable Energy Resources (VER) (solar/wind) generation interconnection requests are determined using the 2017 spring model. Cost Allocated Network Upgrades of peaking units is determined using the 2020 summer peak model. A PSS/E and MUST sensitivity analysis is performed to determine the Distribution Factors (DF), a distribution factor with no contingency that each generation interconnection request has on each new upgrade. The impact each generation interconnection request has on each upgrade project is weighted by the size of each request. Finally the costs due by each request for a particular project are then determined by allocating the portion of each request's impact over the impact of all affecting requests.

For example, assume that there are three Generation Interconnection requests, X, Y, and Z that are responsible for the costs of Upgrade Project '1'. Given that their respective PTDF for the project have been determined, the cost allocation for Generation Interconnection request 'X' for Upgrade Project 1 is found by the following set of steps and formulas:

- Determine an Impact Factor on a given project for all responsible GI requests:

Request X Impact Factor on Upgrade Project 1 = PTDF(%)(X) * MW(X) = X1

Request Y Impact Factor on Upgrade Project 1 = PTDF(%)(Y) * MW(Y) = Y1

Request Z Impact Factor on Upgrade Project 1 = PTDF(%)(Z) * MW(Z) = Z1

- Determine each request's Allocation of Cost for that particular project:

$$\text{Request X's Project 1 Cost Allocation (\$)} = \frac{\text{Network Upgrade Project 1 Cost(\$)} * X1}{X1 + Y1 + Z1}$$

- Repeat previous for each responsible GI request for each Project

The cost allocation of each needed Network Upgrade is determined by the size of each request and its impact on the given project. This allows for the most efficient and reasonable mechanism for sharing the costs of upgrades.

4.1.1 Credits/Compensation for Amounts Advanced for Network Upgrades

Interconnection Customer shall be entitled to either credits or potentially Long Term Congestion Rights (LTCR), otherwise known as compensation, in accordance with Attachment Z2 of the SPP Tariff for any Network Upgrades, including any tax gross-up or any other tax-related payments associated with the Network Upgrades, and not refunded to the Interconnection Customer.

5 Required Interconnection Facilities

The requirement to interconnect the 6,176.9 MW of generation into the existing and proposed transmission systems in the affected areas of the SPP transmission footprint consist of the necessary cost allocated shared facilities listed in Appendix F by upgrade. The interconnection requirements for the cluster total an estimated $512,614,058 for Group 2, 6, 8, and 16 Interconnection Customers only. The total DISIS-2015-002 cost estimate for all Interconnection Customers will be provided once all groups in DISIS-2015-002-4 are studied, but not including the following costs.

- **Costs Not Included** – Costs on Affected Systems for particularly Associated Electric Cooperative Inc. (AECI) and Mid-Continent Independent System Operator (MISO).

Interconnection Facilities specific to each generation interconnection request are listed in Appendix E. A preliminary one-line drawing for each generation interconnection request are listed in Appendix D.

For an explanation of how required Network Upgrades and Interconnection Facilities were determined, refer to the section on “Identification of Network Constraints.”

5.1.1 Facilities Analysis

The interconnecting Transmission Owner for each Interconnection Request has provided its preliminary analysis of required Transmission Owner Interconnection Facilities and the associated Network Upgrades, shown in Appendix D. This analysis was limited only to the expected facilities to be constructed by the Transmission Owner at the Point of Interconnection. These costs are included within one-line diagrams in Appendix D and also listed in Appendix E and F as combined “Interconnection Costs”. If the one-lines and costs in Appendix D have been updated by the Transmission Owner’s Interconnection Facilities Study, those costs will be noted in the appendix. These costs will be further refined by the Transmission Owner as part of the Interconnection Facilities Study. Any additional Network Upgrades identified by this DISIS beyond the Point of Interconnection are defined and estimated by either the Transmission Owner or by SPP. These additional Network Upgrade costs will also be refined further by the Transmission Owner within the Interconnection Facilities Study.

5.1.2 Environmental Review

For Interconnection Requests that result in an interconnection to, or modification to, the transmission facilities of the Western-UGP, a National Environmental Policy Act (NEPA) Environmental Review will be required. The Interconnection Customer will be required to execute and Environmental Review Agreement per Section 8.6.1 of the GIP.

6 Affected Systems Coordination

The following procedures are in place to coordinate with Affected Systems.

- Impacts on Associated Electric Cooperative Inc. (AECI) – For any observed violations of thermal overloads on AECI facilities, AECI has been notified by SPP to evaluate the violations for impacts on its transmission system. AECI has instructed SPP to notify the affected Interconnection Customers after posting of this study to contact AECI for an Affected System Study Agreement to further study the impacts on the AECI system. AECI has evaluated the Interconnection Requests affecting their system.

- Impacts on Mid Continent Independent System Operation (MISO) – Per SPP's agreement with MISO, MISO has been contacted and provided a list of interconnection requests that proceed to move forward into the Interconnection Facilities Study Queue. MISO has evaluated the Interconnection Requests for impacts.
- Impacts on Minnkota Power Cooperative, Inc (MPC) – MPC has been contacted and provided a list of interconnection requests that proceed to move forward into the Interconnection Facilities Study Queue. MP has evaluated the Interconnection Requests for impacts.

- Impacts to other affected systems – For any observed violations of thermal overloads or voltage constraints, SPP will contact the owner of the facility for further information.

7 Power Flow Analysis

7.1.1 Power Flow Analysis Methodology

The ACCC function of PSS/E is used to simulate single element and special (i.e., breaker-to-breaker, multi-element, etc.) contingencies in portions or all of the modeled control areas of SPP, as well as, other control areas external to SPP and the resulting scenarios analyzed. Single element and multi-element contingencies are evaluated.

7.1.2 Power Flow Analysis

A power flow analysis is conducted for each Interconnection Customer's facility using modified versions of the 2016 winter peak (16WP) season, the 2017 spring (17G) and 2017 summer peak (17SP) seasons, the 2020 light load (20L), summer (20SP) and winter peak (20WP) seasons, and the 2025 summer peak (25SP) seasonal models. The output of the Interconnection Customer's facility is offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an ERIS. Certain requests that are also pursuing NRIS have an additional analysis conducted for displacing resources in the interconnecting Transmission Owner's balancing area.

8 Power Flow Results

8.1 Cluster Group 1 (Woodward Area)

In addition to the 3,685.1 MW of previously queued generation in the area, 550.0 MW of new interconnection service was studied. This group was not analyzed for this restudy and previously identified results remain valid.

8.2 Cluster Group 2 (Hitchland Area)

In addition to the 3,626.20 MW of previously queued generation in the area, 200.0 MW of new interconnection service was studied. With the addition of the Group 2 Interconnection Requests, the contingency analysis observed non-convergence for Hitchland – Finney 345kV contingency. Review of the non-convergence results observed potential voltage collapse(s) in the Beaver and Badger areas during the Hitchland – Finney 345kV contingency. The following transmission reinforcements were incrementally added or advanced from their proposed in-service dates to mitigate the potential voltage collapse:

- Woodward – Tatonga – Mathewson – Cimarron 345kV transmission circuit #2
- Walkemeyer 345/115kV project for non-competitive upgrades only
- Beaver County +100 Mvar Static Var Compositor (SVC)

The Woodward – Tatonga – Mathewson – Cimarron 345kV transmission circuit #2 has been previously cost allocated as a regional upgrade per SPP-NTC-200223 from the 2012 SPP Integrated Transmission Plan 10-Year (2012 ITP 10) with a current anticipated in-service date of July, 2018.

Once the non-converged contingencies were solved, additional critical constraints requiring transmission reinforcements are listed below while the complete list of individual constraints requiring additional transmission reinforcements displayed in Appendix G-T.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Non-converged contingency	N/A	N/A	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Non-converged contingency	N/A	N/A	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Non-converged contingency	N/A	N/A	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
Non-converged contingency	N/A	N/A	P12:345:SPS:J07.1.FINN.HITCH
	Mitigation		**Advanced Woodward – Tatonga – Mathewson 345kV CKT 2, Walkemeyer Project, and build +100MVar Static MVar Compensator (SVC) current study upgrade at Beaver County 345kV.**
BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	318.7	115.2245	System Intact
	Mitigation		**Upgrade terminal equipment**
POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	114.9391	System Intact
	Mitigation		Build second Potter County 345/230/13kV Transformer CKT 2

SPSNORTH_STX	1160	108.5659	System Intact Flowgate
	Mitigation		**Updated rating sufficient for mitigation**

8.2.1 Group 2 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service. Limited Operation amounts are calculated based on constraints with the SPP transmission system.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2014-037	0	Voltage Collapse for Finney-Hitchland 345kV System Intact – Bushland Interchange – Potter 345kV and Potter County 345/230/15V Transformer CKT 1
	110	Voltage Collapse for Finney-Hitchland 345kV (assuming Bushland Interchange – Potter 345kV and Potter 345/230/13kV transformer are mitigated before 2025)

8.3 Cluster Group 3 (Spearville Area)

In addition to the 3,230.93 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.4 Cluster Group 4 (Northwest Kansas Area)

In addition to the 1,462.2 MW of previously queued generation in the area, 400.2 MW of new interconnection service was studied. This group was not analyzed for this restudy and previously identified results remain valid.

8.5 Cluster Group 6 (South Texas Panhandle/New Mexico Area)

In addition to the 4,398.77 MW of previously queued generation in the area, 1,011.60 MW of new interconnection service was studied. The large amount of new generation under study in addition to the previous generation already in the queue in this area resulted in potential voltage collapse throughout the entire study area and in all 345kV lines connecting the study area to the rest of the SPP footprint. ERIS contingency analysis observed non-converged contingencies on lines leading to the north and east of the study area were encountered. To mitigate these non-converged contingencies, the following Network Upgrade(s) were required.

- Crawfish Draw 345/230kV Substation and Transformer
  - This project includes tapping and looping in TUCO – Border 345kV and TUCO – Swisher 230kV approximately 3 miles from TUCO substation. A 345/230/13kV Transformer is also required at this location.
- Second circuit 345kV line from TUCO area (Crawfish Draw) to Border 345kV.
  - This project includes Crawfish Draw and Border Substation upgrades to accommodate the additional line terminal.
- Double circuit 345kV from Border to the planned Chisholm 345kV Substation, near Sweetwater, OK.
  - This project includes Border and Chisholm Substation upgrades to accommodate the additional line terminals.

This upgrade also includes advancing the previously assigned Chisholm – Gracemont 345kV Project.

Once the non-converged contingencies were solved, additional critical constraints requiring transmission reinforcements are listed below while the complete list of individual constraints requiring additional transmission reinforcements displayed in Appendix G-T.

Cluster ERIS Constraints			
MONITORED ELEMENT	Limiting Rate A/B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
Non-converged contingency	N/A	N/A	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
Non-converged contingency	N/A	N/A	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
Non-converged contingency	N/A	N/A	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
Non-converged contingency	N/A	N/A	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
Non-converged contingency	N/A	N/A	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
Non-converged contingency	N/A	N/A	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
Non-converged contingency	N/A	N/A	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	102.1609	System Intact
BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	360.92	103.7085	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	350.6	102.2907	NEWHART 230 - PLANT X STATION 230KV CKT 1
GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	128.3977	System Intact

GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	115.3378	System Intact
STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	110.8124	System Intact
STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	109.0736	System Intact
TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	700	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	700	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
	Mitigation		**Build Crawfish Draw 345/230kV Substation and Transformer, second circuit 345kV line from TUCO area (Crawfish Draw) to Border 345kV and double circuit 345kV from Border to the planned Chisholm 345kV Substation.**
CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	111.9034	System Intact
	Mitigation		**Replace existing 115/69/13kV transformer**
CIMARRON - MINCO 345KV CKT 1	956	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
	Mitigation		
CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	547	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
	Mitigation		**Build Crawfish Draw – TUCO 345kV CKT 2. Modify existing Hobbs – Yoakum – TUCO 345kV Project to reterminate and extend 3 miles from TUCO to Crawfish Draw.**
POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	115.2081	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
	Mitigation		**Build second Potter County 345/230/13kV Transformer CKT 2**

8.5.1 Group 6 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service. Limited Operation amounts are calculated based on constraints with the SPP transmission system.

Limited Operation Analysis

Interconnection Request	MW	Constraint that most limits LOIS
GEN-2015-020	0	Multiple
Gen-2015-031	0	Multiple
GEN-2015-056	0	Multiple
GEN-2015-058	0	Multiple
Gen-2015-068	0	Multiple
GEN-2015-075	0	Multiple
GEN-2015-079	0	Multiple
GEN-2015-080	0	Multiple

8.6 Cluster Group 7 (Southwestern Oklahoma Area)

In addition to the 1,923.90 MW of previously queued generation in the area, 413.70 MW of new interconnection service was studied. This group was not analyzed for this restudy and previously identified results remain valid.

8.7 Cluster Group 8 (North Oklahoma/South Central Kansas Area)

In addition to the 5,226.06 MW of previously queued generation in the area, 2,198.00 MW of new interconnection service was studied.

ERIS constraints were observed along the Mathewson – GEN-2015-063 Tap transmission circuit. The emergency rating for Mathewson – GEN-2015-063 Tap 345kV was planned to be 2000 amps (1195 MVA) after Mathewson Substation is in-service. However, after field verification from the Transmission Owner the new rating is 1700 amps (1015 MVA) summer peak emergency due to limiting structural elements. Emporia Energy Center – Swissvale – West Gardner 345kV circuit #1 constraints is alleviated by recent ratings update.

Associated Electric Cooperative Inc. (AECI) has recently completed its review of the Group 08 requests. Cleveland – Silver City 138kV constraint is required for mitigation as determined by AECI for the following request(s). Please refer to the posted Affected System report for details.

- GEN-2015-047
- GEN-2015-066

For Group 8 Cluster Analysis cost allocation, please refer to Appendix E and F.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
	Mitigation		**Current study will be required to upgrade terminal equipment to achieve conductor limit**
SWISSVALE - WEST GARDNER 345KV CKT 1	717	116.8006	HOYT - STRANGER CREEK 345KV CKT 1
EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	121.7232	HOYT - STRANGER CREEK 345KV CKT 1
	Mitigation		**Updated rating**

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
SWISSVALE - WEST GARDNER 345KV CKT 1	717	100.7418	HOYT - STRANGER CREEK 345KV CKT 1
	Mitigation		**Updated rating**

8.7.1 Group 8 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service. Limited Operation amounts are calculated based on constraints with the SPP transmission system. Once the Affected System Impact studies are completed, these Limited Operation amounts could be further restricted by affected systems constraints.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-034	200	None
GEN-2015-047	82	GEN-2015-063 Tap – Mathewson 345kV
GEN-2015-052	300	None
GEN-2015-062	1.2	GEN-2015-063 Tap – Mathewson 345kV
GEN-2015-063	79	GEN-2015-063 Tap – Mathewson 345kV
GEN-2015-066	248.4	None
GEN-2015-069	300	None
GEN-2015-073	196	HOYT - STRANGER CREEK 345KV CKT 1
GEN-2015-083	125	None
GEN-2015-090	220	None

8.8 Cluster Group 9 (Nebraska Area)

In addition to the 2,927.7 MW of previously queued generation in the area, 574.4 MW of new interconnection service was studied. This group was not analyzed for this restudy and previously identified results remain valid.

8.9 Cluster Group 10 (Southeast Oklahoma/Northeast Texas Area)

There is no current study Interconnection Request(s) in the Group 10 geographical region.

8.10 Cluster Group 12 (Northwest Arkansas Area)

In addition to the 30.0 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.11 Cluster Group 13 (Northeast Kansas/Northwest Missouri Area)

In addition to the 634.7 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.12 Cluster Group 14 (South Central Oklahoma Area)

In addition to the 612.50 MW of previously queued generation in the area, 279.0 MW of new interconnection service was studied. This group was not analyzed for this restudy and previously identified results remain valid.

8.13 Group 15 (Eastern South Dakota)

In addition to approximately 1,915.70 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.14 Group 16 (Western North Dakota)

In addition to approximately 3,152.71 MW of previously queued generation in the area, 550.0 MW of new interconnection service was studied. With the addition of the new generation, Dickinson 230/115/13kV transformer circuit #2 will be required to alleviate overloads observed on Dickinson 230/115/13kV transformer circuit #1.

Certain constraints were found to be relieved in the short term by the MISO project, Ellendale MVP – Big Stone South 345kV line. MISO has performed the Affected System Study to determine potential impacts on their system. The results from MISO Affected System study are available at: http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2015_Generation_Studies/MISO%20Affected%20Systems%20SIS%20SPP-DISIS-2015-002%20-%20Addendum_final_091517.pdf

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Non-converged Contingency	N/A	N/A	RIEL - ROSEAU 500KV CKT 1
Non-converged Contingency	N/A	N/A	ROSEAU - ROSEAUM 2 500.00 500KV CKT 1
Non-converged Contingency	N/A	N/A	ELLENDALE - OAKES 230KV CKT 1
Non-converged Contingency	N/A	N/A	FORBES - ROSEAU 500KV CKT 1
BUFFALO - JAMESTOWN 345KV CKT 1	705	109	System Intact
	Mitigation		**Affected System Review**
DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	111.2462	System Intact
	Mitigation		**Install second Dickinson 230/115/13kV Transformer**
NESET 4 230.00 - TIOGA 230KV CKT 1	200	137.5507	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
	Mitigation		**Updated rating**

8.14.1 Group 16 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service. <u>Limited Operation amounts are calculated based on constraints with the SPP transmission system. Once the Affected System Impact studies are completed, these Limited Operation amounts could be further restricted by affected systems constraints.</u>

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-046	0	Dickinson 230/115/13kV System Intact
GEN-2015-096	0	
GEN-2015-098	0	

8.15 Group 17 (Western South Dakota)

In addition to approximately 470.5 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.16 Group 18 (Eastern North Dakota)

In addition to approximately 161.5 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

8.17 Curtailment and System Reliability

In no way does this study guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

9 Stability & Short Circuit Analysis

A stability and short circuit analysis is conducted for each Interconnection Customer using modified versions of the 2015 series SPP Model Development Working Group (MDWG) Models 2016 winter (16WP), 2017 summer (17SP), and 2025 summer peak (25SP) dynamic cases[9]. The stability analysis is conducted with all upgrades in service that are identified in the power flow analysis unless otherwise noted in the individual group stability study. For each group, the interconnection requests are studied at 100% nameplate output while the other groups are dispatched at 20% output for Variable Energy Resource (VER) requests and 100% output for other requests. The output of the Interconnection Customer's facility is offset in each model by a reduction in output of existing online SPP generation. Each Interconnection Request is studied in a Stand Alone scenario in addition to the cluster scenario. A synopsis is included for each group. The entire stability study for each group can be found in the Appendices.

Short-circuit analysis is performed but verification of over-dutied equipment is performed by the Transmission Owner within the Interconnection Facilities Study. Results of that analysis may require additional costs to replace circuit breakers and associated equipment.

9.1 Cluster Group 1 (Woodward Area)

The Group 1 stability analysis was not performed again for this restudy. This group was not analyzed for this restudy and previously identified restudy results remain valid.

9.2 Cluster Group 2 (Hitchland Area)

The Group 2 stability analysis will not performed again for this restudy, unless current assigned power flow upgrades for Group 2 change.

9.3 Cluster Group 3 (Spearville Area)

No current study DISIS-2015-002 Interconnection Customer(s) are located in this geographical group.

9.4 Cluster Group 4 (Northwest Kansas)

The Group 4 stability analysis was not performed again for this restudy. The original analysis in DISIS-2015-002 is still valid.

9.5 Cluster Group 6 (South Texas Panhandle/New Mexico)

The Group 6 stability analysis was performed for this restudy by Mitsubishi Electric Power Products Inc. (MEPPI). Power Factor requirements are listed in the table below. The Stability analysis has shown that the following upgrades are needed to mitigate certain contingencies:

[9] Short Circuit analysis performed only on the 2017 and 2025 Summer Peak seasonal model. Group 6 Stability Analysis also includes 2020 Summer and Winter Peak seasons.

- Previously Assigned:
    - OKU Reactive Power Support
        - 2 x 50 Mvar switched shunts
- Current Study Assigned*:*
    - Crawfish Draw Substation
        - Tap Tuco – Border 345 kV
        - Tap Tuco – Swisher 230 kV
        - Crawfish Draw 345/230 kV transformer
    - Tuco – Crawfish Draw – Border 345 kV circuit #2
        - Reroute Yoakum – Tuco to Yoakum – Crawfish Draw
    - Border – Chisholm 345 kV circuit #1 and #2

With all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the MEPPI Group 6 report.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-020	100	Eaton Power Xpert Solar 1.67MW (solar)	Oasis 115kV	0.95	0.95
GEN-2015-031	150.5	GE 1.79 & GE 2.3 MW (wind)	Tap Amarillo – Swisher 230kV	0.95	0.95
GEN-2015-056	101.2	GE 2.3 MW (wind)	Crossroads 345kV	0.95	0.95
GEN-2015-058	50	TMEIC Solar Inverter 1.667 MW (solar)	Atoka 115kV	0.95	0.95
GEN-2015-068	300	GE 2.0 MW (wind)	Tuco 345kV	0.95	0.95
GEN-2015-075	51.48	GE 3.96 MW (solar)	Carlisle 69kV	0.95	0.95
GEN-2015-079	129.2	GE LV5 3.8 MW (wind)	Tap Yoakum-Hobbs 230kV	0.95	0.95
GEN-2015-080	129.2	GE LV5 3.8 MW (wind)	Tap Yoakum-Hobbs 230kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

9.6 Cluster Group 7 (Southwest Oklahoma)

The Group 7 stability analysis was not performed again for this restudy. The original analysis in DISIS-2015-002 is still valid.

9.7 Cluster Group 8 (South Central Kansas/North Oklahoma)

The Group 8 stability analysis was performed for this restudy by SPP Staff. Power Factor requirements are listed in the table below. Stability analysis has determined that with all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied. One short circuit violation was determined by the affected Transmission Owner. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Group 8 SPP report.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-034	200	Vestas V112-2MW	Ranch Road 345kV	0.95	0.95
GEN-2015-047	300	Vestas V110-2.0 MW	Sooner 345kV Tap	0.95	0.95
GEN-2015-052	300	Vestas V110-2.0 MW	Tap on Open Sky to Rose Hill 345 kV	0.95	0.95
GEN-2015-062	4.5	G.E. 1.8 & 1.79MW	Breckenridge 138kV	0.95	0.95
GEN-2015-063	300	Vestas V110-2MW	Tap on Woodring to Mathewson 345 kV	0.95	0.95
GEN-2015-066	248.4	G.E. 2.3MW	Tap Cleveland - Sooner	0.95	0.95
GEN-2015-069	300	Vestas V110-2MW	Union Ridge 230kV	0.95	0.95
GEN-2015-073	200.1	Siemens 2.3MW	Emporia/Lang 345kV	0.95	0.95
GEN-2015-083	125	G.E. 2.3MW	Belle Plain 138kV	0.95	0.95
GEN-2015-090	220	G.E. 2.0 MW	Wichita -Thistle 345kV Tap	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

9.8 Cluster Group 9 (Nebraska)

The Group 9 stability analysis was not performed again for this restudy. This group was not analyzed for this restudy and previously identified restudy results remain valid.

9.9 Cluster Group 10 (Southeast Oklahoma/Northeast Texas Area)

There is no current study Interconnection Request(s) in the Group 10 geographical region.

9.10 Cluster Group 12 (Northwest Arkansas Area)

There is no current study Interconnection Request(s) in the Group 12 geographical region.

9.11 Cluster Group 13 (Northeast Kansas/Northwest Missouri Area)

There is no current study Interconnection Request(s) in the Group 13 geographical region.

9.12 Cluster Group 14 (South Central Oklahoma)

The Group 14 stability analysis was not performed again for this restudy. The original analysis in DISIS-2015-002 is still valid.

9.13 Cluster Group 15 (Eastern South Dakota)

The Group 15 stability analysis was not performed again for this restudy. The original analysis in DISIS-2015-002 is still valid.

9.14 Cluster Group 16 (Western North Dakota)

The Group 16 stability analysis was performed for this restudy by Mitsubishi Electric Power Products (MEPPI). Power Factor requirements are listed below. Stability analysis has determined that for the prior outage of Belfield to G15-091096-Tap 230kV that the subsequent Bowman to Rhame 230kV outage will produce some wind facilities instabilities and voltage instabilities in the area. The mitigation is curtailment of GEN-2015-096 and GI1414. Also, the stability analysis has shown that several contingencies near the Dawson County 230kV station produced transient overvoltage violations (> 1.2 per unit). However, it was also determined that the transient overvoltage violations are pre-existing and therefore, not caused by the addition of the Group 16 interconnection projects.

With all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the MEPPI Group 16 report.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-046	300	Vestes V110 2.0MW (wind)	Tandee 345kV	0.95	0.95
GEN-2015-096	150	G.E. 2.0MW (wind)	Heart River 230kV	0.95	0.95
GEN-2015-098	100	G.E. 2.0MW (wind)	Beaverhill 230kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

9.15 Cluster Group 17 (Western South Dakota)

There is no current study Interconnection Request(s) in the Group 17 geographical region.

9.16 Cluster Group 18 (Eastern North Dakota)

There is no current study Interconnection Request(s) in the Group 18 geographical region.

10 Conclusion

The minimum cost of interconnecting 6,176.9 MW of new generation interconnection requests included in this DISIS is estimated at $512,614,058 for Group 2, 6, 8, and 16 Interconnection Customers only. The total DISIS-2015-002 cost estimate for all Interconnection Customers will be provided once all groups in DISIS-2015-002-4 are studied, however not including the following costs.

- **Costs Not Included** – Costs on Affected Systems for particularly Associated Electric Cooperative Inc. (AECI) and the Mid-Continent Independent System Operator (MISO).

Interconnection Requests allocated Network Upgrades and Transmission Owner Interconnection Facilities listed in Appendix E and F. For Interconnection Requests that result in an interconnection to, or modification to, the transmission facilities of the Western-UGP (WAPA), a National Environmental Policy Act (NEPA) Environmental Review will be required. The Interconnection Customer will be required to execute and Environmental Review Agreement per Section 8.6.1 of the GIP.

These costs do not include the cost of upgrades of other transmission facilities listed in Appendix H which are Network Constraints. These interconnection costs do not include any cost of any Network Upgrades that are identified as required through the short circuit analysis. Potential over-duty circuit breakers capability will be identified by the Transmission Owner in the Interconnection Facilities Study.

Further refinement of total estimated interconnection costs will be provided, should the Interconnection Customer meet the requirements for acceptance and choose to move into the Interconnection Facilities Study following the posting of this DISIS. The Interconnection Facilities Study may include additional study analysis, additional facility upgrades not yet identified by this DISIS, such as circuit breaker replacements and affected system facilities, and further refinement of existing cost estimates.

The required interconnection costs listed in Appendices E, and F, and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request (TSR) through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP Open Access Transmission Tariff (OATT).

11 Appendices

11.1 A: Generation Interconnection Requests Considered for Impact Study

See next page.

A: Generation Interconnection Requests Considered for Study

Request	Amount	Service	Area	Requested Point of Interconnection	Proposed Point of Interconnection	Requested In-Service Date	In Service Date Delayed Until no earlier than*
ASGI-2015-006	9.00	ER	SWPA	Tupelo 138kV	Tupelo 138kV		TBD
GEN-2014-037	200.00	ER	SPS	Tap Hitchland - Beaver County Dbl Ckt (Optima) 345kV	Tap Hitchland - Beaver County Dbl Ckt (Optima) 345kV	9/30/2017	TBD
GEN-2015-020	100.00	ER	SPS	Oasis 115kV	Oasis 115kV	12/1/2016	TBD
GEN-2015-031	150.50	ER	SPS	Tap Amarillo South - Swisher 230kV	Tap Amarillo South - Swisher 230kV	9/1/2017	TBD
GEN-2015-034	200.00	ER	OKGE	Ranch Road 345kV	Ranch Road 345kV	10/31/2017	TBD
GEN-2015-045	20.00	ER	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV	Tap Lawton - Sunnyside (Terry Road) 345kV	12/1/2017	TBD
GEN-2015-046	300.00	ER	WAPA	Tande 345kV	Tande 345kV	12/1/2017	TBD
GEN-2015-047	300.00	ER	OKGE	Sooner 345kV	Sooner 345kV	12/1/2017	TBD
GEN-2015-048	200.00	ER	OKGE	Cleo Corner 138kV	Cleo Corner 138kV	12/1/2017	TBD
GEN-2015-052	300.00	ER	WERE	Tap Open Sky - Rose Hill 345kV	Tap Open Sky - Rose Hill 345kV	12/1/2017	TBD
GEN-2015-053	50.00	ER	NPPD	Antelope 115kV	Antelope 115kV	12/31/2017	TBD
GEN-2015-055	40.00	ER	WFEC	Erick 138kV	Erick 138kV	10/30/2016	TBD
GEN-2015-056	101.20	ER	SPS	Crossroads 345kV	Crossroads 345kV	12/1/2017	TBD
GEN-2015-057	100.00	ER	OKGE	Minco 345kV	Minco 345kV	12/1/2016	TBD
GEN-2015-058	50.00	ER	SPS	Atoka 115kV	Atoka 115kV	10/1/2017	TBD
GEN-2015-062	4.50	ER	OKGE	GEN-2012-033 Tap 138kV	GEN-2012-033 Tap 138kV	3/1/2016	TBD
GEN-2015-063	300.00	ER	OKGE	Tap Woodring - Mathewson 345kV	Tap Woodring - Mathewson 345kV	12/1/2017	TBD
GEN-2015-064	197.80	ER	SUNCMKEC	Mingo 115kV	Mingo 115kV	11/1/2017	TBD
GEN-2015-065	202.40	ER	SUNCMKEC	Mingo 345kV	Mingo 345kV	11/1/2017	TBD
GEN-2015-066	248.40	ER	OKGE	Tap Cleveland - Sooner 345kV	Tap Cleveland - Sooner 345kV	12/1/2017	TBD
GEN-2015-068	300.00	ER	SPS	TUCO Interchange 345kV	TUCO Interchange 345kV	12/1/2017	TBD
GEN-2015-069	300.00	ER	WERE	Union Ridge 230kV	Union Ridge 230kV	12/1/2017	TBD
GEN-2015-071	200.00	ER	AEPW	Chisholm 345kV	Chisholm 345kV	9/30/2017	TBD
GEN-2015-073	200.10	ER/NR	WERE	Emporia Energy Center 345kV	Emporia Energy Center 345kV	12/31/2018	TBD
GEN-2015-075	51.50	ER	SPS	Carlisle 69kV	Carlisle 69kV	12/1/2018	TBD
GEN-2015-076	158.40	ER	NPPD	Belden 115kV	Belden 115kV	7/31/2017	TBD
GEN-2015-079	129.20	ER	SPS	Tap Yoakum - Hobbs Interchange 230kV	Tap Yoakum - Hobbs Interchange 230kV	10/1/2018	TBD
GEN-2015-080	129.20	ER	SPS	Tap Yoakum - Hobbs Interchange 230kV	Tap Yoakum - Hobbs Interchange 230kV	5/1/2019	TBD
GEN-2015-083	125.00	ER	WERE	Belle Plain 138kV	Belle Plain 138kV	12/31/2017	TBD
GEN-2015-084	51.30	ER	AEPW	Hollis 138kV	Hollis 138kV	12/10/2018	TBD
GEN-2015-085	122.40	ER	AEPW	Altus Junction 138kV	Altus Junction 138kV	12/10/2018	TBD
GEN-2015-087	66.00	ER/NR	NPPD	Tap Fairbury - Hebron 115kV	Tap Fairbury - Hebron 115kV	1/1/2019	TBD
GEN-2015-088	300.00	ER/NR	NPPD	Tap Moore - Pauline 345kV	Tap Moore - Pauline 345kV	1/1/2019	TBD
GEN-2015-090	220.00	ER	WERE	Tap Thistle - Wichita 345kV Dbl CKT	Tap Thistle - Wichita 345kV Dbl CKT	12/1/2017	TBD
GEN-2015-092	250.00	ER	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV	Tap Lawton - Sunnyside (Terry Road) 345kV	12/1/2017	TBD
GEN-2015-093	250.00	ER	OKGE	Gracemont 345kV	Gracemont 345kV	12/1/2017	TBD
GEN-2015-096	150.00	ER	WAPA	Tap Belfied - Rhame 230kV	Tap Belfied - Rhame 230kV	12/31/2017	TBD
GEN-2015-098	100.00	ER	WAPA	Mingusville 230kV	Mingusville 230kV	12/15/2017	TBD
Total:	**6,176.90**						

11.2 B: Prior Queued Interconnection Requests

See next page.

B: Prior Queued Interconnection Requests

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
ASGI-2010-006	150.00	AECI	Remington 138kV	AECI queue Affected Study
ASGI-2010-010	42.20	SPS	Lovington 115kV	Lea County Affected Study
ASGI-2010-020	30.00	SPS	Tap LE-Tatum - LE-Crossroads 69kV	Lea County Affected Study
ASGI-2010-021	15.00	SPS	Tap LE-Saunders Tap - LE-Anderson 69kV	Lea County Affected Study
ASGI-2011-001	27.30	SPS	Lovington 115kV	On-Line
ASGI-2011-002	20.00	SPS	Herring 115kV	On-Line
ASGI-2011-003	10.00	SPS	Hendricks 69kV	On-Line
ASGI-2011-004	20.00	SPS	Pleasant Hill 69kV	Under Study (DISIS-2011-002)
ASGI-2012-002	18.15	SPS	FE-Clovis Interchange 115kV	Under Study (DISIS-2012-002)
ASGI-2012-006	22.50	SUNCMKEC	Tap Hugoton - Rolla 69kV	Under Study (DISIS-2012-001)
ASGI-2013-001	11.50	SPS	PanTex South 115kV	Under Study (DISIS-2013-001)
ASGI-2013-002	18.40	SPS	FE Tucumcari 115kV	Under Study (DISIS-2013-001)
ASGI-2013-003	18.40	SPS	FE Clovis 115kV	Under Study (DISIS-2013-001)
ASGI-2013-004	36.60	SUNCMKEC	Morris 115kV	Under Study (DISIS-2013-002)
ASGI-2013-005	1.65	SPS	FE Clovis 115kV	Under Study (DISIS-2013-002)
ASGI-2013-006	2.00	SPS	SP-Erskine 115kV	
ASGI-2014-001	2.50	SPS	SP-Erskine 115kV	Under Study (DISIS-2014-001)
ASGI-2014-014	56.40	GRDA	Ferguson 69kV	Under Study (DISIS-2014-002)
ASGI-2015-001	6.13	SUNCMKEC	Ninnescah 115kV	Under Study (DISIS-2015-001)
ASGI-2015-002	2.00	SPS	SP-Yuma 69kV	Under Study (DISIS-2015-001)
ASGI-2015-004	56.36	GRDA	Coffeyville City 69kV	Under Study (DISIS-2015-001)
G176	100.00	XEL	Yankee 115kV	
G255	100.00	XEL	Yankee 115kV	MISO Queued Request
G380	150.00	OTP	Rugby 115kV	MISO Queued Request
G408	12.00	XEL	Tap McHenry - Souris 115kV	MISO Queued Request
G502	50.60	MP	Milton Young 230kV	MISO Queued Request
G586	30.00	XEL	Yankee 115kV	
G645	50.00	GRE	Ladish 115kV	MISO Queued Request
G723	10.00	MDU	Haskett 115kV	MISO Queued Request
G736	200.00	OTP	Big Stone South 230kV	
G752	150.00	MDU	Tap Bison - Hettinger 230kV	MISO Queued Request
G788	49.00	GRE	Ladish 115kV	MISO Queued Request
G830	99.00	GRE	GRE McHenry 115kV	MISO Queued Request
GEN-2001-014	96.00	WFEC	Ft Supply 138kV	On-Line
GEN-2001-026	74.30	WFEC	Washita 138kV	On-Line
GEN-2001-033	180.00	SPS	San Juan Tap 230kV	On-Line at 120MW
GEN-2001-036	80.00	SPS	Norton 115kV	On-Line
GEN-2001-037	100.00	OKGE	FPL Moreland Tap 138kV	On-Line
GEN-2001-039A	105.00	SUNCMKEC	Shooting Star Tap 115kV	On-Line
GEN-2001-039M	100.00	SUNCMKEC	Central Plains Tap 115kV	On-Line
GEN-2002-004	200.00	WERE	Latham 345kV	On-Line at 150MW
GEN-2002-005	120.00	WFEC	Red Hills Tap 138kV	On-Line
GEN-2002-008	240.00	SPS	Hitchland 345kV	On-Line at 120MW
GEN-2002-008IS	40.50	WAPA	Edgeley 115kV [Pomona 115kV]	Commercial Operation
GEN-2002-009	80.00	SPS	Hansford 115kV	On-Line
GEN-2002-009IS	40.00	WAPA	Ft Thompson 69kV [Hyde 69kV]	Commercial Operation

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2002-022	240.00	SPS	Bushland 230kV	On-Line
GEN-2002-023N	0.80	NPPD	Harmony 115kV	On-Line
GEN-2002-025A	150.00	SUNCMKEC	Spearville 230kV	On-Line
GEN-2003-004	100.00	WFEC	Washita 138kV	On-Line
GEN-2003-005	100.00	WFEC	Anadarko - Paradise (Blue Canyon) 138kV	On-Line
GEN-2003-006A	200.00	SUNCMKEC	Elm Creek 230kV	On-Line
GEN-2003-019	250.00	MIDW	Smoky Hills Tap 230kV	On-Line
GEN-2003-020	160.00	SPS	Martin 115kV	On-Line
GEN-2003-021N	75.00	NPPD	Ainsworth Wind Tap 115kV	On-Line
GEN-2003-022	120.00	AEPW	Weatherford 138kV	On-Line
GEN-2004-014	154.50	SUNCMKEC	Spearville 230kV	On-Line at 100MW
GEN-2004-020	27.00	AEPW	Weatherford 138kV	On-Line
GEN-2004-023	20.60	WFEC	Washita 138kV	On-Line
GEN-2004-023N	75.00	NPPD	Columbus Co 115kV	On-Line
GEN-2005-003	30.60	WFEC	Washita 138kV	On-Line
GEN-2005-003IS	100.00	WAPA	Nelson 115kV	Commercial Operation
GEN-2005-008	120.00	OKGE	Woodward 138kV	On-Line
GEN-2005-008IS	50.00	WAPA	Hilken 230kV [Ecklund 230kV]	Commercial Operation
GEN-2005-012	250.00	SUNCMKEC	Ironwood 345kV	On-Line at 160MW
GEN-2005-013	201.00	WERE	Caney River 345kV	On-Line
GEN-2006-001IS	10.00	XEL	Marshall 115kV	Commercial Operation
GEN-2006-002	101.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-002IS	51.00	WAPA	Wessington Springs 230kV	Commercial Operation
GEN-2006-006IS	10.00	XEL	Marshall 115kV	Commercial Operation
GEN-2006-015IS	50.00	WAPA	Hilken 230kV [Ecklund 230kV]	Commercial Operation
GEN-2006-018	170.00	SPS	TUCO Interchange 230kV	On-Line
GEN-2006-020N	42.00	NPPD	Bloomfield 115kV	On-Line
GEN-2006-020S	18.90	SPS	DWS Frisco 115kV	On-Line
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV	On-Line
GEN-2006-024S	19.80	WFEC	Buffalo Bear Tap 69kV	On-Line
GEN-2006-026	502.00	SPS	Hobbs 230kV & Hobbs 115kV	On-Line
GEN-2006-031	75.00	MIDW	Knoll 115kV	On-Line
GEN-2006-035	225.00	AEPW	Sweetwater 230kV	On-Line at 132MW
GEN-2006-037N1	75.00	NPPD	Broken Bow 115kV	On-Line
GEN-2006-038N005	80.00	NPPD	Broken Bow 115kV	On-Line
GEN-2006-038N019	80.00	NPPD	Petersburg North 115kV	On-Line
GEN-2006-043	99.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-044	370.00	SPS	Hitchland 345kV	On-Line at 120MW
GEN-2006-044N	40.50	NPPD	North Petersburg 115kV	On-Line
GEN-2006-046	131.00	OKGE	Dewey 138kV	On-Line
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV	On-Line
GEN-2007-013IS	50.00	WAPA	Wessington Springs 230kV	Commercial Operation
GEN-2007-014IS	100.00	WAPA	Wessington Springs 230kV	Commercial Operation
GEN-2007-015IS	100.00	WAPA	Hilken 230kV [Ecklund 230kV]	Commercial Operation
GEN-2007-017IS	166.00	WAPA	Ft Thompson-Grand Island 345kV	On Schedule
GEN-2007-018IS	234.00	WAPA	Ft Thompson-Grand Island 345kV	On Schedule
GEN-2007-020IS	16.00	WAPA	Nelson 115kV	Commercial Operation
GEN-2007-021	201.00	OKGE	Tatonga 345kV	On-Line
GEN-2007-023IS	50.00	WAPA	Formit-Summit 115kV	On Suspension
GEN-2007-025	300.00	WERE	Viola 345kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2007-027IS	99.00	WAPA	Bismarck-Garrison 230kV #1	On Suspension
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV	On-Line at 132MW
GEN-2007-043	200.00	OKGE	Minco 345kV	On-Line
GEN-2007-044	300.00	OKGE	Tatonga 345kV	On-Line at 199MW
GEN-2007-046	200.00	SPS	Hitchland 115kV	On-Line
GEN-2007-050	170.00	OKGE	Woodward EHV 138kV	On-Line at 150MW
GEN-2007-052	150.00	WFEC	Anadarko 138kV	On-Line
GEN-2007-062	425.00	OKGE	Woodward EHV 345kV	On-Line for 225MW, On Schedule and 2017
GEN-2008-003	101.00	OKGE	Woodward EHV 138kV	On-Line
GEN-2008-008IS	5.00	WAPA	Nelson 115kV	Commercial Operation
GEN-2008-013	300.00	OKGE	Hunter 345kV	On-Line at 235MW
GEN-2008-018	250.00	SPS	Finney 345kV	On-Line
GEN-2008-021	42.00	WERE	Wolf Creek 345kV	On-Line
GEN-2008-022	300.00	SPS	Crossroads 345kV	On-Line
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV	On-Line
GEN-2008-037	101.00	WFEC	Slick Hills 138kV	On-Line
GEN-2008-044	197.80	OKGE	Tatonga 345kV	On-Line
GEN-2008-047	300.00	OKGE	Beaver County 345kV	On-Line
GEN-2008-051	322.00	SPS	Potter County 345kV	On-Line at 161MW
GEN-2008-079	99.20	SUNCMKEC	Crooked Creek 115kV	On-Line
GEN-2008-086N02	201.00	NPPD	Meadow Grove 230kV	On-Line
GEN-2008-092	200.60	MIDW	Post Rock 230kV	On-Line
GEN-2008-098	100.80	WERE	Waverly 345kV	On-Line
GEN-2008-119O	60.00	OPPD	S1399 161kV	On-Line
GEN-2008-123N	89.70	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV	On Schedule for 2017
GEN-2008-124	200.10	SUNCMKEC	Ironwood 345kV	On-Line
GEN-2008-129	80.00	KCPL	Pleasant Hill 161kV	On-Line
GEN-2009-001IS	200.00	WAPA	Groton-Watertown 345kV	On Schedule
GEN-2009-006IS	90.00	WAPA	Mission 115kV	On Suspension
GEN-2009-007IS	100.00	WAPA	Mission 115kV	On Suspension
GEN-2009-008	199.50	MIDW	South Hays 230kV	On-Line
GEN-2009-018IS	100.00	WAPA	Groton 115kV	Commercial Operation
GEN-2009-020	48.30	MIDW	Walnut Creek 69kV	On-Line
GEN-2009-020AIS	130.50	WAPA	Tripp Junction 115kV	Commercial Operation
GEN-2009-025	59.80	OKGE	Nardins 69kV	On-Line
GEN-2009-026IS	110.00	WAPA	Dickenson-Heskett 230kV	On Schedule
GEN-2009-040	73.80	WERE	Marshall 115kV	On-Line
GEN-2010-001	300.00	OKGE	Beaver County 345kV	On-Line
GEN-2010-001IS	99.00	WAPA	Bismarck-Glenham 230kV	On Schedule
GEN-2010-003	100.80	WERE	Waverly 345kV	On-Line
GEN-2010-003IS	34.00	WAPA	Wessington Springs 230kV	Commercial Operation
GEN-2010-005	299.20	WERE	Viola 345kV	On-Line at 170MW
GEN-2010-006	205.00	SPS	Jones 230kV	On-Line
GEN-2010-007IS	172.50	WAPA	Antelope Valley 345kV	On Suspension
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV	On-Line
GEN-2010-011	29.70	OKGE	Tatonga 345kV	On-Line
GEN-2010-014	358.80	SPS	Hitchland 345kV	On Schedule for 2018
GEN-2010-036	4.60	WERE	6th Street 115kV	On-Line
GEN-2010-040	300.00	OKGE	Cimarron 345kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2010-041	10.50	OPPD	S1399 161kV	On-Line
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV	On Suspension
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV	On Schedule for 2016
GEN-2010-051	200.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV	On Schedule for 2018
GEN-2010-055	4.50	AEPW	Wekiwa 138kV	On-Line
GEN-2010-057	201.00	MIDW	Rice County 230kV	On-Line
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV	On-Line
GEN-2011-010	100.80	OKGE	Minco 345kV	On-Line
GEN-2011-011	50.00	KCPL	Iatan 345kV	On-Line
GEN-2011-014	201.00	OKGE	Tap Hitchland - Woodward Dbl Ckt (GEN-2011-014 Tap) 345kV	On-Line
GEN-2011-016	200.10	SUNCMKEC	Ironwood 345kV	On Suspension
GEN-2011-018	73.60	NPPD	Steele City 115kV	On-Line
GEN-2011-019	175.00	OKGE	Woodward 345kV	On Schedule for 2017
GEN-2011-020	175.00	OKGE	Woodward 345kV	On Schedule for 2017
GEN-2011-022	299.00	SPS	Hitchland 345kV	On Schedule for 2016 (150MW) and 2017 (149MW)
GEN-2011-025	80.00	SPS	Tap Floyd County - Crosby County 115kV	On Schedule for 2016
GEN-2011-027	120.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV	On Schedule for 2018
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV	On-Line
GEN-2011-040	111.00	OKGE	Carter County 138kV	On-Line
GEN-2011-045	205.00	SPS	Jones 230kV	On-Line
GEN-2011-046	27.00	SPS	Lopez 115kV	On-Line
GEN-2011-048	175.00	SPS	Mustang 230kV	On-Line
GEN-2011-049	250.70	OKGE	Border 345kV	On Schedule for 2016
GEN-2011-050	109.80	AEPW	Santa Fe Tap 138kV	On-Line
GEN-2011-054	300.00	OKGE	Cimarron 345kV	On-Line
GEN-2011-056	3.60	NPPD	Jeffrey 115kV	On-Line
GEN-2011-056A	3.60	NPPD	John 1 115kV	On-Line
GEN-2011-056B	4.50	NPPD	John 2 115kV	On-Line
GEN-2011-057	150.40	WERE	Creswell 138kV	On-Line
GEN-2012-001	61.20	SPS	Cirrus Tap 230kV	On-Line
GEN-2012-004	41.40	OKGE	Carter County 138kV	On-Line
GEN-2012-006IS	125.01	WAPA	Williston-Ch. Creek 230kV	On Schedule
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV	On-Line
GEN-2012-009IS	99.00	WAPA	Fort Randall 115kV	On Suspension
GEN-2012-012IS	75.00	WAPA	Wolf Point-Circle 115kV	On Suspension
GEN-2012-014IS	99.50	WAPA	Groton 115kV	On Schedule
GEN-2012-020	478.00	SPS	TUCO 230kV	On Schedule for 2016
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV	On-Line
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV	On Schedule for 2017
GEN-2012-028	74.80	WFEC	Gotebo 69kV	On-Line
GEN-2012-032	300.00	OKGE	Open Sky 345kV	On-Line
GEN-2012-033	98.10	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV	On-Line
GEN-2012-034	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-035	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-036	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-037	203.00	SPS	TUCO 345kV	On-Line
GEN-2012-041	121.50	OKGE	Ranch Road 345kV	On-Line
GEN-2013-001IS	90.00	WAPA	Summit-Watertown 115kV	On Suspension

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2013-002	50.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2	On Suspension
GEN-2013-007	100.30	OKGE	Tap Prices Falls - Carter 138kV	On-Line
GEN-2013-008	1.20	NPPD	Steele City 115kV	On-Line
GEN-2013-009IS	19.50	WAPA	Redfield NW 115kV	Commercial Operation
GEN-2013-010	99.00	SUNCMKEC	Tap Spearville - Post Rock (North of GEN-2011-017 Tap) 345kV	On Suspension
GEN-2013-011	30.00	AEPW	Turk 138kV	On-Line
GEN-2013-012	147.00	OKGE	Redbud 345kV	On-Line
GEN-2013-016	203.00	SPS	TUCO 345kV	On Schedule for 2017
GEN-2013-019	73.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2	On Suspension
GEN-2013-022	25.00	SPS	Norton 115kV	On-Line
GEN-2013-027	150.00	SPS	Tap Tolk - Yoakum 230kV	On Schedule for 2018
GEN-2013-028	559.50	GRDA	Tap N Tulsa - GRDA 1 345kV	On Schedule for 2017
GEN-2013-029	300.00	OKGE	Renfrow 345kV	On-Line for 151.6MW
GEN-2013-030	300.00	OKGE	Beaver County 345kV	On Schedule for 2016 (200MW) and 2017 (100MW)
GEN-2013-032	204.00	NPPD	Antelope 115kV	On Schedule for 2017
GEN-2013-033	28.00	MIDW	Knoll 115kV	On-Line
GEN-2014-001	200.60	WERE	Tap Wichita - Emporia Energy Center (GEN-2014-001 Tap) 345kV	On Suspension
GEN-2014-001IS	103.70	WAPA	Newell-Maurine 115kV	On Suspension
GEN-2014-002	10.50	OKGE	Tatonga 345kV (GEN-2007-021 POI)	On-Line
GEN-2014-003	15.80	OKGE	Tatonga 345kV (GEN-2007-044 POI)	On-Line
GEN-2014-003IS	91.00	WAPA	Culbertson 115kV	On Schedule
GEN-2014-004	4.00	NPPD	Steele City 115kV (GEN-2011-018 POI)	On-Line
GEN-2014-004IS	384.20	WAPA	Charlie Creek 345kV	IA Pending
GEN-2014-005	5.70	OKGE	Minco 345kV (GEN-2011-010 POI)	On-Line
GEN-2014-006IS	125.00	WAPA	Williston 115kV	On Schedule
GEN-2014-010IS	150.00	WAPA	Neset 115kV	On Schedule
GEN-2014-012	225.00	SPS	Tap Hobbs Interchange - Andrews 230kV	On Suspension
GEN-2014-013	73.50	NPPD	Meadow Grove (GEN-2008-086N2 Sub) 230kV	On-Line
GEN-2014-014IS	151.50	WAPA	Belfield-Rhame 230kV	On Schedule
GEN-2014-020	100.00	AEPW	Tuttle 138kV	On Schedule for 2017
GEN-2014-021	300.00	KCPL	Tap Nebraska City - Mullin Creek 345kV	On Schedule for 2017
GEN-2014-025	2.40	MIDW	Walnut Creek 69kV	On-Line
GEN-2014-028	35.00	EMDE	Riverton 161kV	On-Line
GEN-2014-031	35.80	NPPD	Meadow Grove 230kV	On-Line
GEN-2014-032	10.20	NPPD	Meadow Grove 230kV	On Schedule for 2016
GEN-2014-033	70.00	SPS	Chaves County 115kV	On-Line
GEN-2014-034	70.00	SPS	Chaves County 115kV	On-Line
GEN-2014-035	30.00	SPS	Chaves County 115kV	On Schedule for 2018
GEN-2014-039	73.40	NPPD	Friend 115kV	On Schedule for 2017
GEN-2014-040	320.40	SPS	Castro 115kV	On-Line
GEN-2014-041	120.80	SUNCMKEC	Arnold 115kV	On Suspension
GEN-2014-047	40.00	SPS	Crossroads 345kV	On Schedule for 2017
GEN-2014-056	250.00	OKGE	Minco 345kV	On Schedule for 2016
GEN-2014-057	250.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV	On-Line
GEN-2014-064	248.40	OKGE	Otter 138kV	On Suspension
GEN-2015-001	200.00	OKGE	Ranch Road 345kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2015-004	52.90	OKGE	Border 345kV	On Schedule for 2017
GEN-2015-005	200.10	KCPL	Tap Nebraska City - Sibley 345kV	On-Line
GEN-2015-007	160.00	NPPD	Hoskins 345kV	On Schedule for 2019
GEN-2015-013	120.00	WFEC	Synder 138kV	FACILITY STUDY STAGE
GEN-2015-014	150.00	SPS	Tap Cochran - Lehman 115kV	FACILITY STUDY STAGE
GEN-2015-015	154.60	OKGE	Tap Medford Tap - Coyote 138kV	On Schedule for 2017
GEN-2015-016	200.00	KCPL	Tap Marmaton - Centerville 161kV	On Schedule for 2018
GEN-2015-021	20.00	SUNCMKEC	Johnson Corner 115kV	On Schedule for 2019
GEN-2015-022	112.00	SPS	Swisher 115kV	FACILITY STUDY STAGE
GEN-2015-023	300.70	NPPD	Holt County 345kV	On Schedule for 2020
GEN-2015-024	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT	On-Line
GEN-2015-025	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT	On-Line
GEN-2015-029	161.00	OKGE	Tatonga 345kV	On Suspension
GEN-2015-030	200.10	OKGE	Sooner 345kV	On Suspension
Gray County Wind (Montezuma)	110.00	SUNCMKEC	Gray County Tap 115kV	On-Line
J003	20.00	MDU	Baker 115kV	MISO Queued Request
J249	180.00	MDU	MDU Tatanka 230kV	MISO Queued Request
J262	100.00	OTP	Jamestown 345	MISO Queued Request
J263	100.00	OTP	Jamestown 345	MISO Queued Request
J290	150.00	XEL	Tap Glenboro South - Rugby 230kV	MISO Queued Request
J316	150.00	MDU	MDU 230 kV Tatanka-Ellendale line	MISO Queued Request
J436	150.00	OTP	Big Stone South 345kV	MISO Queued Request
J437	150.00	OTP	Big Stone South 345kV	MISO Queued Request
J442	200.00	OTP	Big Stone 230 kV	MISO Queued Request
Llano Estacado (White Deer)	80.00	SPS	Llano Wind 115kV	On-Line
MPC01200	98.90	OTP	Maple River 230kV	IA Pending
MPC02100	100.00	OTP	Tap Center - Mandan 230kV	On-Line
NPPD Distributed (Broken Bow)	8.30	NPPD	Broken Bow 115kV	On-Line
NPPD Distributed (Buffalo County Solar)	10.00	NPPD	Kearney Northeast	On-Line
NPPD Distributed (Burt County Wind)	12.00	NPPD	Tekamah & Oakland 115kV	On-Line
NPPD Distributed (Burwell)	3.00	NPPD	Ord 115kV	On-Line
NPPD Distributed (Columbus Hydro)	45.00	NPPD	Columbus 115kV	On-Line
NPPD Distributed (North Platte - Lexington)	54.00	NPPD	Multiple: Jeffrey 115kV, John_1 115kV, John_2 115kV	On-Line
NPPD Distributed (Ord)	11.90	NPPD	Ord 115kV	On-Line
NPPD Distributed (Stuart)	2.10	NPPD	Ainsworth 115kV	On-Line
SPS Distributed (Carson)	10.00	SPS	Martin 115kV	On-Line
SPS Distributed (Dumas 19th St)	20.00	SPS	Dumas 19th Street 115kV	On-Line
SPS Distributed (Etter)	20.00	SPS	Etter 115kV	On-Line
SPS Distributed (Hopi)	10.00	SPS	Hopi 115kV	On-Line
SPS Distributed (Jal)	10.00	SPS	S Jal 115kV	On-Line
SPS Distributed (Lea Road)	10.00	SPS	Lea Road 115kV	On-Line
SPS Distributed (Monument)	10.00	SPS	Monument 115kV	On-Line
SPS Distributed (Moore E)	25.00	SPS	Moore East 115kV	On-Line
SPS Distributed (Ocotillo)	10.00	SPS	S_Jal 115kV	On-Line
SPS Distributed (Sherman)	20.00	SPS	Sherman 115kV	On-Line
SPS Distributed (Spearman)	10.00	SPS	Spearman 69kV	On-Line
SPS Distributed (TC-Texas County)	20.00	SPS	Texas County 115kV	On-Line
SPS Distributed (Yuma)	2.57	SPS	SP-Yuma 69kV	On-Line
Total:	**33,478.5**			

11.3 C: Study Groupings

See next page

C. Study Groups

GROUP 1: WOODWARD AREA			
Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-014	96.00	WFEC	Ft Supply 138kV
GEN-2001-037	100.00	OKGE	FPL Moreland Tap 138kV
GEN-2005-008	120.00	OKGE	Woodward 138kV
GEN-2006-024S	19.80	WFEC	Buffalo Bear Tap 69kV
GEN-2006-046	131.00	OKGE	Dewey 138kV
GEN-2007-021	201.00	OKGE	Tatonga 345kV
GEN-2007-043	200.00	OKGE	Minco 345kV
GEN-2007-044	300.00	OKGE	Tatonga 345kV
GEN-2007-050	170.00	OKGE	Woodward EHV 138kV
GEN-2007-062	425.00	OKGE	Woodward EHV 345kV
GEN-2008-003	101.00	OKGE	Woodward EHV 138kV
GEN-2008-044	197.80	OKGE	Tatonga 345kV
GEN-2010-011	29.70	OKGE	Tatonga 345kV
GEN-2010-040	300.00	OKGE	Cimarron 345kV
GEN-2011-010	100.80	OKGE	Minco 345kV
GEN-2011-019	175.00	OKGE	Woodward 345kV
GEN-2011-020	175.00	OKGE	Woodward 345kV
GEN-2011-054	300.00	OKGE	Cimarron 345kV
GEN-2014-002	10.50	OKGE	Tatonga 345kV (GEN-2007-021 POI)
GEN-2014-003	15.80	OKGE	Tatonga 345kV (GEN-2007-044 POI)
GEN-2014-005	5.70	OKGE	Minco 345kV (GEN-2011-010 POI)
GEN-2014-020	100.00	AEPW	Tuttle 138kV
GEN-2014-056	250.00	OKGE	Minco 345kV
GEN-2015-029	161.00	OKGE	Tatonga 345kV
PRIOR QUEUED SUBTOTAL	3,685.10		
GEN-2015-048	200.00	OKGE	Cleo Corner 138kV
GEN-2015-057	100.00	OKGE	Minco 345kV
GEN-2015-093	250.00	OKGE	Gracemont 345kV
CURRENT CLUSTER SUBTOTAL	550.00		
AREA TOTAL	4,235.10		

GROUP 2: HITCHLAND AREA			
Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2011-002	20.00	SPS	Herring 115kV
ASGI-2013-001	11.50	SPS	PanTex South 115kV
GEN-2002-008	240.00	SPS	Hitchland 345kV
GEN-2002-009	80.00	SPS	Hansford 115kV
GEN-2002-022	240.00	SPS	Bushland 230kV
GEN-2003-020	160.00	SPS	Martin 115kV
GEN-2006-020S	18.90	SPS	DWS Frisco 115kV
GEN-2006-044	370.00	SPS	Hitchland 345kV
GEN-2007-046	200.00	SPS	Hitchland 115kV
GEN-2008-047	300.00	OKGE	Beaver County 345kV
GEN-2008-051	322.00	SPS	Potter County 345kV
GEN-2010-001	300.00	OKGE	Beaver County 345kV
GEN-2010-014	358.80	SPS	Hitchland 345kV
GEN-2011-014	201.00	OKGE	Tap Hitchland - Woodward Dbl Ckt (GEN-2011-014 Tap) 345kV
GEN-2011-022	299.00	SPS	Hitchland 345kV
GEN-2013-030	300.00	OKGE	Beaver County 345kV
Llano Estacado (White Deer)	80.00	SPS	Llano Wind 115kV
SPS Distributed (Carson)	10.00	SPS	Martin 115kV
SPS Distributed (Dumas 19th St)	20.00	SPS	Dumas 19th Street 115kV
SPS Distributed (Etter)	20.00	SPS	Etter 115kV
SPS Distributed (Moore E)	25.00	SPS	Moore East 115kV
SPS Distributed (Sherman)	20.00	SPS	Sherman 115kV
SPS Distributed (Spearman)	10.00	SPS	Spearman 69kV
SPS Distributed (TC-Texas County)	20.00	SPS	Texas County 115kV
PRIOR QUEUED SUBTOTAL	**3,626.20**		
GEN-2014-037	200.00	SPS	Tap Hitchland - Beaver County Dbl Ckt (Optima) 345kV
CURRENT CLUSTER SUBTOTAL	**200.00**		
AREA TOTAL	**3,826.20**		

GROUP 3: SPEARVILLE AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2012-006	22.50	SUNCMKEC	Tap Hugoton - Rolla 69kV
ASGI-2015-001	6.13	SUNCMKEC	Ninnescah 115kV
GEN-2001-039A	105.00	SUNCMKEC	Shooting Star Tap 115kV
GEN-2002-025A	150.00	SUNCMKEC	Spearville 230kV
GEN-2004-014	154.50	SUNCMKEC	Spearville 230kV
GEN-2005-012	250.00	SUNCMKEC	Ironwood 345kV
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV
GEN-2008-018	250.00	SPS	Finney 345kV
GEN-2008-079	99.20	SUNCMKEC	Crooked Creek 115kV
GEN-2008-124	200.10	SUNCMKEC	Ironwood 345kV
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV
GEN-2011-016	200.10	SUNCMKEC	Ironwood 345kV
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV
GEN-2013-010	99.00	SUNCMKEC	Tap Spearville - Post Rock (North of GEN-2011-017 Tap) 345kV
GEN-2015-021	20.00	SUNCMKEC	Johnson Corner 115kV
Gray County Wind (Montezuma)	110.00	SUNCMKEC	Gray County Tap 115kV
PRIOR QUEUED SUBTOTAL	**3,230.93**		
AREA TOTAL	**3,230.93**		

GROUP 4: NORTHWEST KANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2013-004	36.60	SUNCMKEC	Morris 115kV
GEN-2001-039M	100.00	SUNCMKEC	Central Plains Tap 115kV
GEN-2003-006A	200.00	SUNCMKEC	Elm Creek 230kV
GEN-2003-019	250.00	MIDW	Smoky Hills Tap 230kV
GEN-2006-031	75.00	MIDW	Knoll 115kV
GEN-2008-092	200.60	MIDW	Post Rock 230kV
GEN-2009-008	199.50	MIDW	South Hays 230kV
GEN-2009-020	48.30	MIDW	Walnut Creek 69kV
GEN-2010-057	201.00	MIDW	Rice County 230kV
GEN-2013-033	28.00	MIDW	Knoll 115kV
GEN-2014-025	2.40	MIDW	Walnut Creek 69kV
GEN-2014-041	120.80	SUNCMKEC	Arnold 115kV
PRIOR QUEUED SUBTOTAL	**1,462.20**		
GEN-2015-064	197.80	SUNCMKEC	Mingo 115kV
GEN-2015-065	202.40	SUNCMKEC	Mingo 345kV
CURRENT CLUSTER SUBTOTAL	**400.20**		
AREA TOTAL	**1,862.40**		

GROUP 6: SOUTH TEXAS PANHANDLE/NEW MEXICO AREA			
Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2010-010	42.20	SPS	Lovington 115kV
ASGI-2010-020	30.00	SPS	Tap LE-Tatum - LE-Crossroads 69kV
ASGI-2010-021	15.00	SPS	Tap LE-Saunders Tap - LE-Anderson 69kV
ASGI-2011-001	27.30	SPS	Lovington 115kV
ASGI-2011-003	10.00	SPS	Hendricks 69kV
ASGI-2011-004	20.00	SPS	Pleasant Hill 69kV
ASGI-2012-002	18.15	SPS	FE-Clovis Interchange 115kV
ASGI-2013-002	18.40	SPS	FE Tucumcari 115kV
ASGI-2013-003	18.40	SPS	FE Clovis 115kV
ASGI-2013-005	1.65	SPS	FE Clovis 115kV
ASGI-2013-006	2.00	SPS	SP-Erskine 115kV
ASGI-2014-001	2.50	SPS	SP-Erskine 115kV
ASGI-2015-002	2.00	SPS	SP-Yuma 69kV
GEN-2001-033	180.00	SPS	San Juan Tap 230kV
GEN-2001-036	80.00	SPS	Norton 115kV
GEN-2006-018	170.00	SPS	TUCO Interchange 230kV
GEN-2006-026	502.00	SPS	Hobbs 230kV & Hobbs 115kV
GEN-2008-022	300.00	SPS	Crossroads 345kV
GEN-2010-006	205.00	SPS	Jones 230kV
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV
GEN-2011-025	80.00	SPS	Tap Floyd County - Crosby County 115kV
GEN-2011-045	205.00	SPS	Jones 230kV
GEN-2011-046	27.00	SPS	Lopez 115kV
GEN-2011-048	175.00	SPS	Mustang 230kV
GEN-2012-001	61.20	SPS	Cirrus Tap 230kV
GEN-2012-020	478.00	SPS	TUCO 230kV
GEN-2012-034	7.00	SPS	Mustang 230kV
GEN-2012-035	7.00	SPS	Mustang 230kV
GEN-2012-036	7.00	SPS	Mustang 230kV
GEN-2012-037	203.00	SPS	TUCO 345kV
GEN-2013-016	203.00	SPS	TUCO 345kV
GEN-2013-022	25.00	SPS	Norton 115kV
GEN-2013-027	150.00	SPS	Tap Tolk - Yoakum 230kV
GEN-2014-012	225.00	SPS	Tap Hobbs Interchange - Andrews 230kV
GEN-2014-033	70.00	SPS	Chaves County 115kV
GEN-2014-034	70.00	SPS	Chaves County 115kV
GEN-2014-035	30.00	SPS	Chaves County 115kV
GEN-2014-040	320.40	SPS	Castro 115kV
GEN-2014-047	40.00	SPS	Crossroads 345kV
GEN-2015-014	150.00	SPS	Tap Cochran - Lehman 115kV
GEN-2015-022	112.00	SPS	Swisher 115kV
SPS Distributed (Hopi)	10.00	SPS	Hopi 115kV
SPS Distributed (Jal)	10.00	SPS	S Jal 115kV
SPS Distributed (Lea Road)	10.00	SPS	Lea Road 115kV
SPS Distributed (Monument)	10.00	SPS	Monument 115kV
SPS Distributed (Ocotillo)	10.00	SPS	S_Jal 115kV
SPS Distributed (Yuma)	2.57	SPS	SP-Yuma 69kV
PRIOR QUEUED SUBTOTAL	**4,398.77**		

GEN-2015-020	100.00	SPS	Oasis 115kV
GEN-2015-031	150.50	SPS	Tap Amarillo South - Swisher 230kV
GEN-2015-056	101.20	SPS	Crossroads 345kV
GEN-2015-058	50.00	SPS	Atoka 115kV
GEN-2015-068	300.00	SPS	TUCO Interchange 345kV
GEN-2015-075	51.50	SPS	Carlisle 69kV
GEN-2015-079	129.20	SPS	Tap Yoakum - Hobbs Interchange 230kV
GEN-2015-080	129.20	SPS	Tap Yoakum - Hobbs Interchange 230kV
CURRENT CLUSTER SUBTOTAL	**1,011.60**		
AREA TOTAL	**5,410.37**		

GROUP 7: SOUTHWEST OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-026	74.30	WFEC	Washita 138kV
GEN-2002-005	120.00	WFEC	Red Hills Tap 138kV
GEN-2003-004	100.00	WFEC	Washita 138kV
GEN-2003-005	100.00	WFEC	Anadarko - Paradise (Blue Canyon) 138kV
GEN-2003-022	120.00	AEPW	Weatherford 138kV
GEN-2004-020	27.00	AEPW	Weatherford 138kV
GEN-2004-023	20.60	WFEC	Washita 138kV
GEN-2005-003	30.60	WFEC	Washita 138kV
GEN-2006-002	101.00	AEPW	Sweetwater 230kV
GEN-2006-035	225.00	AEPW	Sweetwater 230kV
GEN-2006-043	99.00	AEPW	Sweetwater 230kV
GEN-2007-052	150.00	WFEC	Anadarko 138kV
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV
GEN-2008-037	101.00	WFEC	Slick Hills 138kV
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV
GEN-2011-049	250.70	OKGE	Border 345kV
GEN-2012-028	74.80	WFEC	Gotebo 69kV
GEN-2015-004	52.90	OKGE	Border 345kV
GEN-2015-013	120.00	WFEC	Synder 138kV
PRIOR QUEUED SUBTOTAL	**1,923.90**		
GEN-2015-055	40.00	WFEC	Erick 138kV
GEN-2015-071	200.00	AEPW	Chisholm 345kV
GEN-2015-084	51.30	AEPW	Hollis 138kV
GEN-2015-085	122.40	AEPW	Altus Junction 138kV
CURRENT CLUSTER SUBTOTAL	**413.70**		
AREA TOTAL	**2,337.60**		

GROUP 8: NORTH OKLAHOMA/SOUTH CENTRAL KANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2010-006	150.00	AECI	Remington 138kV
ASGI-2014-014	56.40	GRDA	Ferguson 69kV
ASGI-2015-004	56.36	GRDA	Coffeyville City 69kV
GEN-2002-004	200.00	WERE	Latham 345kV
GEN-2005-013	201.00	WERE	Caney River 345kV
GEN-2007-025	300.00	WERE	Viola 345kV
GEN-2008-013	300.00	OKGE	Hunter 345kV
GEN-2008-021	42.00	WERE	Wolf Creek 345kV
GEN-2008-098	100.80	WERE	Waverly 345kV
GEN-2009-025	59.80	OKGE	Nardins 69kV
GEN-2010-003	100.80	WERE	Waverly 345kV
GEN-2010-005	299.20	WERE	Viola 345kV
GEN-2010-055	4.50	AEPW	Wekiwa 138kV
GEN-2011-057	150.40	WERE	Creswell 138kV
GEN-2012-032	300.00	OKGE	Open Sky 345kV
GEN-2012-033	98.10	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV
GEN-2012-041	121.50	OKGE	Ranch Road 345kV
GEN-2013-012	147.00	OKGE	Redbud 345kV
GEN-2013-028	559.50	GRDA	Tap N Tulsa - GRDA 1 345kV
GEN-2013-029	300.00	OKGE	Renfrow 345kV
GEN-2014-001	200.60	WERE	Tap Wichita - Emporia Energy Center (GEN-2014-001 Tap) 345kV

GEN-2014-028	35.00	EMDE	Riverton 161kV
GEN-2014-064	248.40	OKGE	Otter 138kV
GEN-2015-001	200.00	OKGE	Ranch Road 345kV
GEN-2015-015	154.60	OKGE	Tap Medford Tap - Coyote 138kV
GEN-2015-016	200.00	KCPL	Tap Marmaton - Centerville 161kV
GEN-2015-024	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT
GEN-2015-025	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT
GEN-2015-030	200.10	OKGE	Sooner 345kV
PRIOR QUEUED SUBTOTAL	**5,226.06**		
GEN-2015-034	200.00	OKGE	Ranch Road 345kV
GEN-2015-047	300.00	OKGE	Sooner 345kV
GEN-2015-052	300.00	WERE	Tap Open Sky - Rose Hill 345kV
GEN-2015-062	4.50	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV
GEN-2015-063	300.00	OKGE	Tap Woodring - Mathewson 345kV
GEN-2015-066	248.40	OKGE	Tap Cleveland - Sooner 345kV
GEN-2015-069	300.00	WERE	Union Ridge 230kV
GEN-2015-073	200.10	WERE	Emporia Energy Center 345kV
GEN-2015-083	125.00	WERE	Belle Plain 138kV
GEN-2015-090	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT
CURRENT CLUSTER SUBTOTAL	**2,198.00**		
AREA TOTAL	**7,424.06**		

GROUP 9: NEBRASKA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2002-023N	0.80	NPPD	Harmony 115kV
GEN-2003-021N	75.00	NPPD	Ainsworth Wind Tap 115kV
GEN-2004-023N	75.00	NPPD	Columbus Co 115kV
GEN-2006-020N	42.00	NPPD	Bloomfield 115kV
GEN-2006-037N1	75.00	NPPD	Broken Bow 115kV
GEN-2006-038N005	80.00	NPPD	Broken Bow 115kV
GEN-2006-038N019	80.00	NPPD	Petersburg North 115kV
GEN-2006-044N	40.50	NPPD	North Petersburg 115kV
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV
GEN-2007-017IS	166.00	WAPA	Ft Thompson-Grand Island 345kV
GEN-2007-018IS	234.00	WAPA	Ft Thompson-Grand Island 345kV
GEN-2008-086N02	201.00	NPPD	Meadow Grove 230kV
GEN-2008-119O	60.00	OPPD	S1399 161kV
GEN-2008-123N	89.70	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV
GEN-2009-040	73.80	WERE	Marshall 115kV
GEN-2010-041	10.50	OPPD	S1399 161kV
GEN-2010-051	200.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV
GEN-2011-018	73.60	NPPD	Steele City 115kV
GEN-2011-027	120.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV
GEN-2011-056	3.60	NPPD	Jeffrey 115kV
GEN-2011-056A	3.60	NPPD	John 1 115kV
GEN-2011-056B	4.50	NPPD	John 2 115kV
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV
GEN-2013-002	50.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2
GEN-2013-008	1.20	NPPD	Steele City 115kV
GEN-2013-019	73.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2
GEN-2013-032	204.00	NPPD	Antelope 115kV
GEN-2014-004	4.00	NPPD	Steele City 115kV (GEN-2011-018 POI)
GEN-2014-013	73.50	NPPD	Meadow Grove (GEN-2008-086N2 Sub) 230kV

GEN-2014-031	35.80	NPPD	Meadow Grove 230kV
GEN-2014-032	10.20	NPPD	Meadow Grove 230kV
GEN-2014-039	73.40	NPPD	Friend 115kV
GEN-2015-007	160.00	NPPD	Hoskins 345kV
GEN-2015-023	300.70	NPPD	Holt County 345kV
NPPD Distributed (Broken Bow)	8.30	NPPD	Broken Bow 115kV
NPPD Distributed (Buffalo County Solar)	10.00	NPPD	Kearney Northeast
NPPD Distributed (Burt County Wind)	12.00	NPPD	Tekamah & Oakland 115kV
NPPD Distributed (Burwell)	3.00	NPPD	Ord 115kV
NPPD Distributed (Columbus Hydro)	45.00	NPPD	Columbus 115kV
NPPD Distributed (North Platte - Lexington)	54.00	NPPD	Multiple: Jeffrey 115kV, John_1 115kV, John_2 115kV
NPPD Distributed (Ord)	11.90	NPPD	Ord 115kV
NPPD Distributed (Stuart)	2.10	NPPD	Ainsworth 115kV
PRIOR QUEUED SUBTOTAL	**2,927.70**		
GEN-2015-053	50.00	NPPD	Antelope 115kV
GEN-2015-076	158.40	NPPD	Belden 115kV
GEN-2015-087	66.00	NPPD	Tap Fairbury - Hebron 115kV
GEN-2015-088	300.00	NPPD	Tap Moore - Pauline 345kV
CURRENT CLUSTER SUBTOTAL	**574.40**		
AREA TOTAL	**3,502.10**		

GROUP 10: SOUTHEAST OKLAHOMA/NORTHEAST TEXAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
AREA TOTAL	**0.00**		

GROUP 12: NORTHWEST ARKANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2013-011	30.00	AEPW	Turk 138kV
PRIOR QUEUED SUBTOTAL	**30.00**		
AREA TOTAL	**30.00**		

GROUP 13: NORTHWEST MISSOURI AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2008-129	80.00	KCPL	Pleasant Hill 161kV
GEN-2010-036	4.60	WERE	6th Street 115kV
GEN-2011-011	50.00	KCPL	Iatan 345kV
GEN-2014-021	300.00	KCPL	Tap Nebraska City - Mullin Creek 345kV
GEN-2015-005	200.10	KCPL	Tap Nebraska City - Sibley 345kV
PRIOR QUEUED SUBTOTAL	**634.70**		
AREA TOTAL	**634.70**		

GROUP 14: SOUTH CENTRAL OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2011-040	111.00	OKGE	Carter County 138kV
GEN-2011-050	109.80	AEPW	Santa Fe Tap 138kV
GEN-2012-004	41.40	OKGE	Carter County 138kV
GEN-2013-007	100.30	OKGE	Tap Prices Falls - Carter 138kV
GEN-2014-057	250.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV
PRIOR QUEUED SUBTOTAL	**612.50**		
ASGI-2015-006	9.00	SWPA	Tupelo 138kV
GEN-2015-045	20.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV
GEN-2015-092	250.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV
CURRENT CLUSTER SUBTOTAL	**279.00**		
AREA TOTAL	**891.50**		

GROUP 15: E-SOUTH DAKOTA AREA

Request	Capacity	Area	Proposed Point of Interconnection
G176	100.00	XEL	Yankee 115kV
G255	100.00	XEL	Yankee 115kV
G586	30.00	XEL	Yankee 115kV
G736	200.00	OTP	Big Stone South 230kV
GEN-2002-009IS	40.00	WAPA	Ft Thompson 69kV [Hyde 69kV]
GEN-2007-013IS	50.00	WAPA	Wessington Springs 230kV
GEN-2007-014IS	100.00	WAPA	Wessington Springs 230kV
GEN-2007-023IS	50.00	WAPA	Formit-Summit 115kV
GEN-2009-001IS	200.00	WAPA	Groton-Watertown 345kV
GEN-2009-018IS	100.00	WAPA	Groton 115kV
GEN-2010-001IS	99.00	WAPA	Bismarck-Glenham 230kV
GEN-2010-003IS	34.00	WAPA	Wessington Springs 230kV
GEN-2012-014IS	99.50	WAPA	Groton 115kV
GEN-2013-001IS	90.00	WAPA	Summit-Watertown 115kV
GEN-2013-009IS	19.50	WAPA	Redfield NW 115kV
GEN-2014-001IS	103.70	WAPA	Newell-Maurine 115kV
J436	150.00	OTP	Big Stone South 345kV
J437	150.00	OTP	Big Stone South 345kV
J442	200.00	OTP	Big Stone 230 kV
PRIOR QUEUED SUBTOTAL	**1,915.70**		
AREA TOTAL	**1,915.70**		

GROUP 16: W-NORTH DAKOTA AREA

Request	Capacity	Area	Proposed Point of Interconnection
G380	150.00	OTP	Rugby 115kV
G408	12.00	XEL	Tap McHenry - Souris 115kV
G502	50.60	MP	Milton Young 230kV
G645	50.00	GRE	Ladish 115kV
G723	10.00	MDU	Haskett 115kV
G752	150.00	MDU	Tap Bison - Hettinger 230kV
G788	49.00	GRE	Ladish 115kV
G830	99.00	GRE	GRE McHenry 115kV
GEN-2005-008IS	50.00	WAPA	Hilken 230kV [Ecklund 230kV]
GEN-2006-015IS	50.00	WAPA	Hilken 230kV [Ecklund 230kV]
GEN-2007-015IS	100.00	WAPA	Hilken 230kV [Ecklund 230kV]
GEN-2007-027IS	99.00	WAPA	Bismarck-Garrison 230kV #1
GEN-2009-026IS	110.00	WAPA	Dickenson-Heskett 230kV
GEN-2010-007IS	172.50	WAPA	Antelope Valley 345kV
GEN-2012-006IS	125.01	WAPA	Williston-Ch. Creek 230kV
GEN-2012-012IS	75.00	WAPA	Wolf Point-Circle 115kV
GEN-2014-003IS	91.00	WAPA	Culbertson 115kV
GEN-2014-004IS	384.20	WAPA	Charlie Creek 345kV
GEN-2014-006IS	125.00	WAPA	Williston 115kV
GEN-2014-010IS	150.00	WAPA	Neset 115kV
GEN-2014-014IS	151.50	WAPA	Belfield-Rhame 230kV
J003	20.00	MDU	Baker 115kV
J249	180.00	MDU	MDU Tatanka 230kV
J262	100.00	OTP	Jamestown 345
J263	100.00	OTP	Jamestown 345
J290	150.00	XEL	Tap Glenboro South - Rugby 230kV
J316	150.00	MDU	MDU 230 kV Tatanka-Ellendale line
MPC01200	98.90	OTP	Maple River 230kV
MPC02100	100.00	OTP	Tap Center - Mandan 230kV
PRIOR QUEUED SUBTOTAL	**3,152.71**		
GEN-2015-046	300.00	WAPA	Tande 345kV
GEN-2015-096	150.00	WAPA	Tap Belfied - Rhame 230kV
GEN-2015-098	100.00	WAPA	Mingusville 230kV
CURRENT CLUSTER SUBTOTAL	**550.00**		
AREA TOTAL	**3,702.71**		

GROUP 17: W-SOUTH DAKOTA AREA			
Request	Capacity	Area	Proposed Point of Interconnection
GEN-2006-002IS	51.00	WAPA	Wessington Springs 230kV
GEN-2009-006IS	90.00	WAPA	Mission 115kV
GEN-2009-007IS	100.00	WAPA	Mission 115kV
GEN-2009-020AIS	130.50	WAPA	Tripp Junction 115kV
GEN-2012-009IS	99.00	WAPA	Fort Randall 115kV
PRIOR QUEUED SUBTOTAL	**470.50**		
AREA TOTAL	**470.00**		

GROUP 18: E-NORTH DAKOTA AREA			
Request	Capacity	Area	Proposed Point of Interconnection
GEN-2002-008IS	40.50	WAPA	Edgeley 115kV [Pomona 115kV]
GEN-2005-003IS	100.00	WAPA	Nelson 115kV
GEN-2007-020IS	16.00	WAPA	Nelson 115kV
GEN-2008-008IS	5.00	WAPA	Nelson 115kV
PRIOR QUEUED SUBTOTAL	**161.50**		
AREA TOTAL	**161.50**		

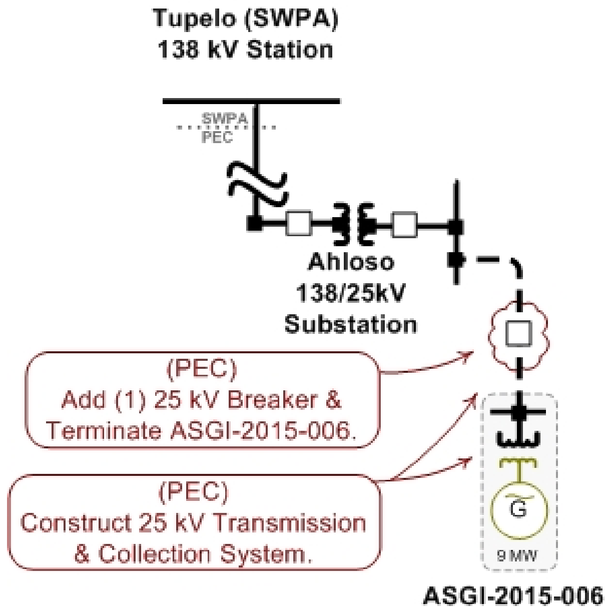
CLUSTER TOTAL (CURRENT STUDY)	**6,176.9**	MW
PQ TOTAL (PRIOR QUEUED)	**33,478.5**	MW
CLUSTER TOTAL (INCLUDING PRIOR QUEUED)	**39,655.4**	MW

11.4 D: Proposed Point of Interconnection One Line Diagrams

See next page

*Note: If not denoted otherwise for Affected System Generator Interconnection Requests (ASGI) interconnection cost estimate could include distribution system or third party system network upgrades and costs estimates.

ASGI-2015-006
Estimated Cluster Analysis Interconnection Cost: $0



*** Interconnection Cost Estimate(s) only include Affected System Interconnection costs**

GEN-2014-037

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-020

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-031

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-034

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-045

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-046

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-047

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-048

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-052

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-053

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-055

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-056

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-057

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-058

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-062

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-063

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-064

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-065

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-066

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-068

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-069

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-071

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-073

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-075

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-076

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-079

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-080

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-083

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-084

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-085

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-087

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-088

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-090

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-092

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-093

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-096

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

GEN-2015-098

Please refer to the Interconnection Facility Study (IFS) Report for latest interconnection cost and upgrade descriptions

11.5 E: Cost Allocation per Interconnection Request (Including Prior Queued Upgrades)

Important Note:

****WITHDRAWAL OF HIGHER QUEUED PROJECTS WILL CAUSE A RESTUDY AND MAY RESULT IN HIGHER INTERCONNECTION COSTS****

This section shows each Generation Interconnection Request Customer, their current study impacted Network Upgrades, and the previously allocated upgrades upon which they rely to accommodate their interconnection to the transmission system.

The costs associated with the current study Network Upgrades are allocated to the Customers shown in this report.

In addition should a higher queued request, defined as one this study includes as a prior queued request, withdraw, the Network Upgrades assigned to the withdrawn request may be reallocated to the remaining requests that have an impact on the Network Upgrade under a restudy. Also, should an Interconnection Request choose to go into service prior to the operation date of any necessary Network Upgrades, the costs associated with those upgrades may be reallocated to the impacted Interconnection Request. The actual costs allocated to each Generation Interconnection Request Customer will be determined at the time of a restudy.

The required interconnection costs listed do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. In addition, costs associated with a short circuit analysis will be allocated should the Interconnection Request Customer choose to execute a Facility Study Agreement.

There may be additional costs allocated to each Customer. See Appendix F for more details.

Appendix E. Cost Allocation Per Request

(Including Previously Allocated Network Upgrades*)

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2014-037			
Beaver County 345kV Reactive Power Support Install +100Mvar SVC at Beaver County Substation.	Current Study	$26,264,777	$26,264,777
Bushland - Potter County 230kV CKT 1 Replace line traps at both terminals	Current Study	$250,000	$250,000
GEN-2014-037 Interconnection Costs See One-Line Diagram.	Current Study	$7,365,364	$7,365,364
Potter County 345/230/13kV Transformer CKT 2 Build second 345/230/13kV transformer at Potter County	Current Study	$1,883,123	$5,924,670
Tatonga - Mathewson 345kV CKT 2 Build second 345kV circuit from Tatonga - Matthewson @ 3000 amps per ITP10.	Previously Allocated		$56,387,700
Woodward - Tatonga 345kV CKT 2 Build second 345 kV circuit from Woodward - Tatonga @ 3000 ampts per ITP10.	Previously Allocated		$50,594,040
	Current Study Total	$35,763,264	
GEN-2015-020			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$7,675,588	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$21,209,774	$234,229,687
Crawfish Draw - Tuco 345kV CKT 2 Build second circuit from Crawfish Draw - Tuco 345 kV	Current Study	$74,039	$3,600,000
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$496,389	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$4,318,768	$24,764,205
GEN-2015-020 Interconnection Costs See One-Line Diagram.	Current Study	$10,606,653	$10,606,653
Potter County 345/230/13kV Transformer CKT 2 Build second 345/230/13kV transformer at Potter County	Current Study	$1,288,265	$5,924,670

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$45,669,476	
GEN-2015-031			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$6,888,625	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$19,237,565	$234,229,687
Crawfish Draw - Tuco 345kV CKT 2 Build second circuit from Crawfish Draw - Tuco 345 kV	Current Study	$118,029	$3,600,000
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$105,675	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$6,923,962	$24,764,205
GEN-2015-031 Interconnection Costs See One-Line Diagram.	Current Study	$7,567,148	$7,567,148
Potter County 345/230/13kV Transformer CKT 2 Build second 345/230/13kV transformer at Potter County	Current Study	$1,508,180	$5,924,670
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$42,349,184	
GEN-2015-034			
GEN-2015-034 Interconnection Costs See One-Line Diagram.	Current Study	$2,025,000	$2,025,000
	Current Study Total	$2,025,000	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2015-046			
Dickinson 230/115/13.8kV CKT 2 Build new 230/115/13.8kV Transformer circuit #2 at Dickinson and expand Dickinson 115kV switchyard	Current Study	$4,677,679	$11,764,180
GEN-2015-046 Interconnection Costs See One-Line Diagram.	Current Study	$3,759,097	$3,759,097
MISO Affected System Study See section 4 power flow analysis.	Current Study	$TBD	$TBD
Kummer Ridge - Roundup Project Per SPP-NTC-200417 assigned in 2016 ITPNT	Previously Allocated		$52,312,877
Neset - Tande 230kV CKT 1 Build new 230kV line from Neset - Tande	Previously Allocated		$3,000,000
Neset 230kV Terminal Upgrade(s) Install necessary terminal equInstall necessary terminal upgrades at Neset 230kV to accommodate new 230kV line from new Tande substation	Previously Allocated		$4,000,000
Tande 345/230kV Substation Construct new 345kV Tande Substation & Tande 345/230/13kV transformer Construct new 345kV Tande Substation adjacent to the existing 230kV Neset Substation and	Previously Allocated		$18,000,000
	Current Study Total	$8,436,776	
GEN-2015-047			
Cleveland - Silver City 138kV CKT 1 AECI Affected System Study is required	Current Study	$TBD	$TBD
GEN-2015-047 Interconnection Costs See One-Line Diagram.	Current Study	$5,934,580	$5,934,580
GEN-2015-063 Tap - Mathewson 345kV CKT 1 Replace 89 structures	Current Study	$679,061	$4,277,161
	Current Study Total	$6,613,641	
GEN-2015-052			
GEN-2015-052 Interconnection Costs See One-Line Diagram.	Current Study	$15,582,434	$15,582,434
	Current Study Total	$15,582,434	
GEN-2015-056			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$8,120,237	$84,546,835

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$22,446,658	$234,229,687
Crawfish Draw - Tuco 345kV CKT 2 Build second circuit from Crawfish Draw - Tuco 345 kV	Current Study	$37,729	$3,600,000
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$647,303	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$3,969,291	$24,764,205
GEN-2015-056 Interconnection Costs See One-Line Diagram.	Current Study	$5,636,099	$5,636,099
Potter County 345/230/13kV Transformer CKT 2 Build second 345/230/13kV transformer at Potter County	Current Study	$1,245,102	$5,924,670
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$42,102,419	

GEN-2015-058

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$4,200,711	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$11,617,327	$234,229,687
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$473,015	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$1,445,835	$24,764,205
GEN-2015-058 Interconnection Costs See One-Line Diagram.	Current Study	$2,751,641	$2,751,641
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$20,488,528	
GEN-2015-062			
GEN-2015-062 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
GEN-2015-063 Tap - Mathewson 345kV CKT 1 Replace 89 structures	Current Study	$17,594	$4,277,161
	Current Study Total	$17,594	
GEN-2015-063			
GEN-2015-063 Interconnection Costs See One-Line Diagram.	Current Study	$10,313,000	$10,313,000
GEN-2015-063 Tap - Mathewson 345kV CKT 1 Replace 89 structures	Current Study	$3,580,506	$4,277,161
	Current Study Total	$13,893,506	
GEN-2015-066			
Cleveland - Silver City 138kV CKT 1 AECI Affected System Study is required	Current Study	$TBD	$TBD
GEN-2015-066 Interconnection Costs See One-Line Diagram.	Current Study	$10,313,000	$10,313,000
	Current Study Total	$10,313,000	
GEN-2015-068			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$30,272,481	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$83,930,960	$234,229,687
Crawfish Draw - Tuco 345kV CKT 2 Build second circuit from Crawfish Draw - Tuco 345 kV	Current Study	$3,225,423	$3,600,000
GEN-2015-068 Interconnection Costs See One-Line Diagram.	Current Study	$4,831,332	$4,831,332

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
	Current Study Total	$122,260,196	
GEN-2015-069			
GEN-2015-069 Interconnection Costs See One-Line Diagram.	Current Study	$2,755,752	$2,755,752
	Current Study Total	$2,755,752	
GEN-2015-073			
GEN-2015-073 Interconnection Costs See One-Line Diagram.	Current Study	$2,576,628	$2,576,628
	Current Study Total	$2,576,628	
GEN-2015-075			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$4,704,534	$84,546,835
Carlisle 115/69/13kV Transformer CKT 1 Replace existing Carlisle 115/69/13kV Transformer circuit #1	Current Study	$2,244,618	$2,244,618
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$13,032,294	$234,229,687
Crawfish Draw - Tuco 345kV CKT 2 Build second circuit from Crawfish Draw - Tuco 345 kV	Current Study	$144,779	$3,600,000
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$95,848	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$3,079,841	$24,764,205
GEN-2015-075 Interconnection Costs See One-Line Diagram.	Current Study	$2,753,456	$2,753,456
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$26,055,371	
GEN-2015-079			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$11,342,330	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$31,377,554	$234,229,687
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$1,590,885	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$2,513,254	$24,764,205
GEN-2015-079 Interconnection Costs See One-Line Diagram.	Current Study	$6,382,720	$6,382,720
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$53,206,743	
GEN-2015-080			
Border - Chisholm 345kV CKT 1 & 2 Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations	Current Study	$11,342,330	$84,546,835
Crawfish Draw - Border 345kV CKT 2 Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border	Current Study	$31,377,554	$234,229,687
Crawfish Draw - Yoakum 345kV Retermination Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV	Current Study	$1,590,885	$5,000,000
Crawfish Draw 345/230kV Substation Upgrade Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 230kV.	Current Study	$2,513,254	$24,764,205
GEN-2015-080 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Chisholm - Gracemont 345kV CKT 1 Per SPP-NTC-200255 and 200240 (Total Project E&C Cost Shown)	Previously Allocated		$162,952,357
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 345/230/13.2kV Transformer CKT 1 Replace existing TUCO 345/230/13.2kV Transformer circuit #1 with 640MVA.	Previously Allocated		$3,347,036
	Current Study Total	$46,824,023	
GEN-2015-083			
GEN-2015-083 Interconnection Costs See One-Line Diagram.	Current Study	$6,713,963	$6,713,963
	Current Study Total	$6,713,963	
GEN-2015-090			
GEN-2015-090 Interconnection Costs See One-Line Diagram.	Current Study	$10,000	$10,000
	Current Study Total	$10,000	
GEN-2015-096			
Dickinson 230/115/13.8kV CKT 2 Build new 230/115/13.8kV Transformer circuit #2 at Dickinson and expand Dickinson 115kV switchyard	Current Study	$4,435,730	$11,764,180
GEN-2015-096 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
MISO Affected System Study See section 4 power flow analysis.	Current Study	$TBD	$TBD
Kummer Ridge - Roundup Project Per SPP-NTC-200417 assigned in 2016 ITPNT	Previously Allocated		$52,312,877
Tande 345/230kV Substation Construct new 345kV Tande Substation & Tande 345/230/13kV transformer Construct new 345kV Tande Substation adjacent to the existing 230kV Neset Substation and	Previously Allocated		$18,000,000
	Current Study Total	$4,435,730	
GEN-2015-098			
Dickinson 230/115/13.8kV CKT 2 Build new 230/115/13.8kV Transformer circuit #2 at Dickinson and expand Dickinson 115kV switchyard	Current Study	$2,650,770	$11,764,180
GEN-2015-098 Interconnection Costs See One-Line Diagram.	Current Study	$1,870,058	$1,870,058

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
MISO Affected System Study See section 4 power flow analysis.	Current Study	$TBD	$TBD
Kummer Ridge - Roundup Project Per SPP-NTC-200417 assigned in 2016 ITPNT	Previously Allocated		$52,312,877
Tande 345/230kV Substation Construct new 345kV Tande Substation & Tande 345/230/13kV transformer Construct new 345kV Tande Substation adjacent to the existing 230kV Neset Substation and	Previously Allocated		$18,000,000
	Current Study Total	$4,520,828	

TOTAL CURRENT STUDY COSTS: $512,614,058*

* Does not include cost to mitigate possible AECI and MISO Affected System Upgrade(s).

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

11.6 F: Cost Allocation per Proposed Study Network Upgrade

Important Note:

****WITHDRAWAL OF HIGHER QUEUED PROJECTS WILL CAUSE A RESTUDY AND MAY RESULT IN HIGHER INTERCONNECTION COSTS****

This section shows each Direct Assigned Facility and Network Upgrade and the Generation Interconnection Request Customer(s) which have an impact in this study assuming all higher queued projects remain in the queue and achieve commercial operation.

The required interconnection costs listed do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. In addition, costs associated with a short circuit analysis will be allocated should the Interconnection Request Customer choose to execute a Facility Study Agreement.

There may be additional costs allocated to each Customer. See Appendix E for more details.

Appendix F. Cost Allocation by Upgrade

Beaver County 345kV Reactive Power Support **$26,264,777**

Install +100Mvar SVC at Beaver County Substation.

GEN-2014-037	$26,264,777
Total Allocated Costs	**$26,264,777**

Border - Chisholm 345kV CKT 1 & 2 **$84,546,835**

Build 30 miles of double 345 kV circuit from Border (OKGE) - Chisholm (AEP); Upgrade Border and Chisholm substations

GEN-2015-020	$7,675,588
GEN-2015-031	$6,888,625
GEN-2015-056	$8,120,237
GEN-2015-058	$4,200,711
GEN-2015-068	$30,272,481
GEN-2015-075	$4,704,534
GEN-2015-079	$11,342,330
GEN-2015-080	$11,342,330
Total Allocated Costs	**$84,546,835**

Bushland - Potter County 230kV CKT 1 **$250,000**

Replace line traps at both terminals

GEN-2014-037	$250,000
Total Allocated Costs	**$250,000**

Carlisle 115/69/13kV Transformer CKT 1 **$2,244,618**

Replace existing Carlisle 115/69/13kV Transformer circuit #1

GEN-2015-075	$2,244,618
Total Allocated Costs	**$2,244,618**

Cleveland - Silver City 138kV CKT 1 **$TBD by AECI**

AECI Affected System Study is required

GEN-2015-047	$TBD by AECI
GEN-2015-066	$TBD by AECI
Total Allocated Costs	**$TBD by AECI**

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Crawfish Draw - Border 345kV CKT 2 **$234,229,687**

Build approximately 194 miles of second circuit 345kV from Crawfish Draw - Border

GEN-2015-020	$21,209,774
GEN-2015-031	$19,237,565
GEN-2015-056	$22,446,658
GEN-2015-058	$11,617,327
GEN-2015-068	$83,930,960
GEN-2015-075	$13,032,294
GEN-2015-079	$31,377,554
GEN-2015-080	$31,377,554
Total Allocated Costs	**$234,229,687**

Crawfish Draw - Tuco 345kV CKT 2 **$3,600,000**

Build second circuit from Crawfish Draw - Tuco 345 kV

GEN-2015-020	$74,039
GEN-2015-031	$118,029
GEN-2015-056	$37,729
GEN-2015-068	$3,225,423
GEN-2015-075	$144,779
Total Allocated Costs	**$3,600,000**

Crawfish Draw - Yoakum 345kV Retermination **$5,000,000**

Incremental Upgrade for SPP-NTC-200283 to reterminate TUCO terminal to Crawfish Draw terminal by adding approximately 3 miles of 345kV

GEN-2015-020	$496,389
GEN-2015-031	$105,675
GEN-2015-056	$647,303
GEN-2015-058	$473,015
GEN-2015-075	$95,848
GEN-2015-079	$1,590,885
GEN-2015-080	$1,590,885
Total Allocated Costs	**$5,000,000**

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Crawfish Draw 345/230kV Substation Upgrade **$24,764,205**

Tap Border-TUCO approximately 3 miles from TUCO, build Crawfish Draw 345kV substation, add 345/230/13.2kV transformer, and tie on TUCO-Swisher 2

GEN-2015-020	$4,318,768
GEN-2015-031	$6,923,962
GEN-2015-056	$3,969,291
GEN-2015-058	$1,445,835
GEN-2015-075	$3,079,841
GEN-2015-079	$2,513,254
GEN-2015-080	$2,513,254
Total Allocated Costs	**$24,764,205**

Dickinson 230/115/13.8kV CKT 2 **$11,764,180**

Build new 230/115/13.8kV Transformer circuit #2 at Dickinson and expand Dickinson 115kV switchyard

GEN-2015-046	$4,677,679
GEN-2015-096	$4,435,730
GEN-2015-098	$2,650,770
Total Allocated Costs	**$11,764,180**

GEN-2014-037 Interconnection Costs **$7,365,364**

See One-Line Diagram.

GEN-2014-037	$7,365,364
Total Allocated Costs	**$7,365,364**

GEN-2015-020 Interconnection Costs **$10,606,653**

See One-Line Diagram.

GEN-2015-020	$10,606,653
Total Allocated Costs	**$10,606,653**

GEN-2015-031 Interconnection Costs **$7,567,148**

See One-Line Diagram.

GEN-2015-031	$7,567,148
Total Allocated Costs	**$7,567,148**

GEN-2015-034 Interconnection Costs **$2,025,000**

See One-Line Diagram.

GEN-2015-034	$2,025,000
Total Allocated Costs	**$2,025,000**

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

GEN-2015-046 Interconnection Costs			**$3,759,097**
See One-Line Diagram.			
	GEN-2015-046	$3,759,097	
	Total Allocated Costs	**$3,759,097**	
GEN-2015-047 Interconnection Costs			**$5,934,580**
See One-Line Diagram.			
	GEN-2015-047	$5,934,580	
	Total Allocated Costs	**$5,934,580**	
GEN-2015-052 Interconnection Costs			**$15,582,434**
See One-Line Diagram.			
	GEN-2015-052	$15,582,434	
	Total Allocated Costs	**$15,582,434**	
GEN-2015-056 Interconnection Costs			**$5,636,099**
See One-Line Diagram.			
	GEN-2015-056	$5,636,099	
	Total Allocated Costs	**$5,636,099**	
GEN-2015-058 Interconnection Costs			**$2,751,641**
See One-Line Diagram.			
	GEN-2015-058	$2,751,641	
	Total Allocated Costs	**$2,751,641**	
GEN-2015-062 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-062	$0	
	Total Allocated Costs	**$0**	
GEN-2015-063 Interconnection Costs			**$10,313,000**
See One-Line Diagram.			
	GEN-2015-063	$10,313,000	
	Total Allocated Costs	**$10,313,000**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

GEN-2015-063 Tap - Mathewson 345kV CKT 1			**$4,277,161**
Replace 89 structures			
	GEN-2015-047	$679,061	
	GEN-2015-062	$17,594	
	GEN-2015-063	$3,580,506	
	Total Allocated Costs	**$4,277,161**	
GEN-2015-066 Interconnection Costs			**$10,313,000**
See One-Line Diagram.			
	GEN-2015-066	$10,313,000	
	Total Allocated Costs	**$10,313,000**	
GEN-2015-068 Interconnection Costs			**$4,831,332**
See One-Line Diagram.			
	GEN-2015-068	$4,831,332	
	Total Allocated Costs	**$4,831,332**	
GEN-2015-069 Interconnection Costs			**$2,755,752**
See One-Line Diagram.			
	GEN-2015-069	$2,755,752	
	Total Allocated Costs	**$2,755,752**	
GEN-2015-073 Interconnection Costs			**$2,576,628**
See One-Line Diagram.			
	GEN-2015-073	$2,576,628	
	Total Allocated Costs	**$2,576,628**	
GEN-2015-075 Interconnection Costs			**$2,753,456**
See One-Line Diagram.			
	GEN-2015-075	$2,753,456	
	Total Allocated Costs	**$2,753,456**	
GEN-2015-079 Interconnection Costs			**$6,382,720**
See One-Line Diagram.			
	GEN-2015-079	$6,382,720	
	Total Allocated Costs	**$6,382,720**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

GEN-2015-080 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-080	$0	
	Total Allocated Costs	**$0**	

GEN-2015-083 Interconnection Costs			**$6,713,963**
See One-Line Diagram.			
	GEN-2015-083	$6,713,963	
	Total Allocated Costs	**$6,713,963**	

GEN-2015-090 Interconnection Costs			**$10,000**
See One-Line Diagram.			
	GEN-2015-090	$10,000	
	Total Allocated Costs	**$10,000**	

GEN-2015-096 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-096	$0	
	Total Allocated Costs	**$0**	

GEN-2015-098 Interconnection Costs			**$1,870,058**
See One-Line Diagram.			
	GEN-2015-098	$1,870,058	
	Total Allocated Costs	**$1,870,058**	

MISO Affected System Study			**$TBD by MISO**
See section 4 power flow analysis.			
	GEN-2015-046	$TBD by MISO	
	GEN-2015-096	$TBD by MISO	
	GEN-2015-098	$TBD by MISO	
	Total Allocated Costs	**$TBD by MISO**	

Potter County 345/230/13kV Transformer CKT 2			**$5,924,670**
Build second 345/230/13kV transformer at Potter County			
	GEN-2014-037	$1,883,123	
	GEN-2015-020	$1,288,265	
	GEN-2015-031	$1,508,180	
	GEN-2015-056	$1,245,102	
	Total Allocated Costs	**$5,924,670**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

11.7 G-T: Thermal Power Flow Analysis (Constraints Requiring Transmission Reinforcement)

See next page.

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNSLock-Blown up	02ALL	0	16WP	G14_037		Non-Converged Contingency	987.16	1082.77	0.25488	-	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
FDNSLock-Blown up	02ALL	0	16WP	G14_037		Non-Converged Contingency	956.09	1051.7	0.25488	-	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
FDNSLock-Blown up	02ALL	0	17G	G14_037		Non-Converged Contingency	956.09	1051.7	0.24783	-	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
FDNSLock-Blown up	02ALL	0	17G	G14_037		Non-Converged Contingency	956.09	1051.7	0.24783	-	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
FDNSLock-Blown up	02ALL	0	17SP	G14_037		Non-Converged Contingency	956.09	1051.7	0.26910	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNSLock-Blown up	02ALL	0	20L	G14_037		Non-Converged Contingency	0.0	0.0	0.45450	-	P12:345:SPS:J07.1.FINN.HITCH
FDNSLock-Blown up	02ALL	0	20L	G14_037		Non-Converged Contingency	956.09	1051.7	0.24087	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNSLock-Blown up	02ALL	0	20L	G14_037		Non-Converged Contingency	956.09	1051.7	0.24087	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNSLock-Blown up	02ALL	0	20WP	G14_037		Non-Converged Contingency	987.16	1082.77	0.25136	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNSLock-Blown up	02ALL	2	20WP	G14_037		Non-Converged Contingency	987.16	1082.77	0.25140	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNS	02ALL	0	25SP	G14_037	TO->FROM	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	318.7	350.57	0.03595	115.2245	System Intact
FDNS	02ALL	0	25SP	G14_037	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.11154	114.9391	System Intact
FDNS	02ALL	0	25SP	G14_037	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.11154	111.592	System Intact
FDNS	02ALL	0	25SP	G14_037	FROM->TO	SPSNORTH_STX	1160.0	1160.0	0.14109	108.5659	System Intact
FDNS	02ALL	2	25SP	G14_037	TO->FROM	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	318.7	350.57	0.03594	115.0108	System Intact
FDNS	02ALL	2	25SP	G14_037	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.11154	113.7652	System Intact
FDNS	02ALL	2	25SP	G14_037	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.11154	110.9394	System Intact
FDNS	02ALL	2	25SP	G14_037	FROM->TO	SPSNORTH_STX	1160.0	1160.0	0.14105	108.5097	System Intact
FDNS	02ALL	3	25SP	G14_037	FROM->TO	SPSNORTH_STX	1160.0	1160.0	0.14458	110.3253	System Intact
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	1022	1124	0.24088	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	987.2	1082.8	0.19474	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	1792	1972	0.17998	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	1792	1792	0.17998	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	439	439	0.1186	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_020		Non-Converged Contingency	329.05	360.92	0.09664	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_020		Non-Converged Contingency	956	1042	0.23911	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	956	1042	0.20767	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	956	1042	0.20767	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	1792	1972	0.1689	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	1792	1972	0.1689	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	1792	1792	0.1689	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	956.1	1051.7	0.15848	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_020		Non-Converged Contingency	956.1	1051.7	0.15848	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_020		Non-Converged Contingency	956	1042	0.24163	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_020		Non-Converged Contingency	1792	1792	0.19314	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	1022	1124	0.23575	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	1792	1972	0.18872	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	1792	1792	0.18872	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	987.2	1082.8	0.18232	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	560	560	0.18232	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_020		Non-Converged Contingency	421	439	0.1036	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	16WP	G15_020	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	329.05	360.92	0.21703	103.7085	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.1036	102.1609	System Intact
FDNS	06ALL	0	17G	G15_020	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.1147	101.6182	System Intact
FDNS	06ALL	0	20L	G15_020	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.0875	100.7218	System Intact
FDNS	06ALL	0	17G	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09352	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.08457	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09664	118.487	System Intact
FDNS	06ALL	0	20L	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07104	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09478	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_020	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08744	105.1284	System Intact
FDNS	06ALL	0	17G	G15_020	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.09702	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_020	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.08765	110.0553	System Intact
FDNS	06ALL	0	20L	G15_020	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.07398	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_020	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.10031	104.6951	System Intact
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	115.2081	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	115.2019	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	115.1855	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	112.3278	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	112.3228	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.2123	112.3087	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19913	109.0205	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19913	109.0205	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19913	107.0216	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19913	107.0216	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19943	106.1067	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19943	106.1067	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21303	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21303	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20199	104.9809	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20199	104.9809	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21303	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21303	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19943	104.3461	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.19943	104.3461	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20199	103.6447	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20199	103.6447	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	17G	G15_020	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.1147	110.8124	System Intact
FDNS	06ALL	0	20L	G15_020	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.0875	104.1613	System Intact
FDNS	06ALL	0	17G	G15_020	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.1147	109.0736	System Intact
FDNS	06ALL	0	20L	G15_020	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.0875	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.39931	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.39931	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.39931	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.39931	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.25593	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.25593	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.38822	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.23576	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.23576	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.23576	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.23576	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.25593	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.25593	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_020	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.38822	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.39931	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.39931	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.39931	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.39931	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.25593	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.25593	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.38822	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.23576	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.23576	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.23576	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.23576	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.25593	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.25593	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_020	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.38822	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_020	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23781	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.21978	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_020	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23305	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.22249	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.25572	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.22644	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.23378	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.25037	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_020	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.22965	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27384	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27384	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27037	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24642	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27037	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24642	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27805	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27805	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27994	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27994	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27662	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_020	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27662	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.19551	100.8732	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.19551	100.8732	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.19551	99.4	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_020	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.19551	99.4	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	1022	1124	0.22073	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	987.2	1082.8	0.2057	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	1792	1972	0.16111	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	1792	1792	0.16111	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	439	439	0.13083	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_031		Non-Converged Contingency	329.05	360.92	0.10699	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_031		Non-Converged Contingency	956	1042	0.21776	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	956	1042	0.17856	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	956	1042	0.17856	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	956.1	1051.7	0.17651	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	956.1	1051.7	0.17651	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	1792	1972	0.14163	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	1792	1972	0.14163	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_031		Non-Converged Contingency	1792	1792	0.14163	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNSLock-Blown up	06ALL	0	20SP	G15_031		Non-Converged Contingency	956	1042	0.21252	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_031		Non-Converged Contingency	1792	1792	0.16586	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	1022	1124	0.20664	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	987.2	1082.8	0.20036	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	560	560	0.20036	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	1792	1972	0.16144	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	1792	1792	0.16144	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_031		Non-Converged Contingency	421	439	0.11988	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.11988	102.1609	System Intact
FDNS	06ALL	0	17G	G15_031	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.12692	101.6182	System Intact
FDNS	06ALL	0	20L	G15_031	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.10378	100.7218	System Intact
FDNS	06ALL	0	17G	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.10387	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09826	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.10699	118.487	System Intact
FDNS	06ALL	0	20L	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08474	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.10556	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_031	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.10113	105.1284	System Intact
FDNS	06ALL	0	17G	G15_031	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.10742	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_031	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.10148	110.0553	System Intact
FDNS	06ALL	0	20L	G15_031	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.08781	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_031	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.11071	104.6951	System Intact
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	115.2081	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	115.2019	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	115.1855	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	112.3278	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	112.3228	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23505	112.3087	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21988	109.0205	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21988	109.0205	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21988	107.0216	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.21988	107.0216	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22017	106.1067	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22017	106.1067	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23443	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23443	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22143	104.9809	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22143	104.9809	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20655	104.8751	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20654	104.8321	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23443	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23443	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22017	104.3461	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22017	104.3461	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22143	103.6447	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.22143	103.6447	MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20655	102.5662	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20654	102.5263	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	06ALL	0	17G	G15_031	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.12692	110.8124	System Intact
FDNS	06ALL	0	20L	G15_031	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.10378	104.1613	System Intact
FDNS	06ALL	0	17G	G15_031	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.12692	109.0736	System Intact
FDNS	06ALL	0	20L	G15_031	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.10378	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.36228	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.36228	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.36228	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.36228	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.30431	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.30431	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.3512	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.28414	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.28414	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.28414	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.28414	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.30431	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.30431	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_031	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.3512	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.36228	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.36228	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.36228	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.36228	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.30431	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.30431	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.3512	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.28414	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.28414	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.28414	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.28414	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.30431	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.30431	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_031	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.3512	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_031	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.22928	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.20644	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_031	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.22452	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24766	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24766	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24895	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.22025	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.24895	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.22025	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25662	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25662	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25376	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25376	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25357	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_031	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25357	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.21106	100.8732	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.21106	100.8732	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.21106	99.4	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.21106	99.4	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_031	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.20814	99.3	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	16ALL	0	16WP	G15_046	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.02965	101.8878	System Intact
FDNS	16ALL	0	16WP	G15_046	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.02965	100.9745	System Intact
FDNS	16ALL	0	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90563	137.5507	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90563	137.5507	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90563	137.5064	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	17SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90395	131.2465	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	17SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90395	131.2465	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	17SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90395	131.1528	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	17G	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90391	128.2229	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	17G	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90391	128.2229	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	17G	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90391	128.0799	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	126.104	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	126.104	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	126.0798	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90393	122.2257	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90393	122.2257	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90393	122.1874	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	120.648	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	120.6376	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90566	120.6376	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90564	115.1737	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	0	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90564	115.1557	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	0	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.90564	115.1557	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	0	17G	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37855	112.6471	JUDSON 4230.00 - WILLISTON 230KV CKT 1
FDNS	16ALL	0	17G	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37855	112.647	JUDSON 3345.00 (JUDSON KU1A) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37891	111.8995	JUDSON 4230.00 - WILLISTON 230KV CKT 1
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37891	111.8967	JUDSON 3345.00 (JUDSON KU1A) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	16ALL	0	17SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37895	103.0218	JUDSON 3345.00 (JUDSON KU1A) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	16ALL	0	17SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37895	103.021	JUDSON 4230.00 - WILLISTON 230KV CKT 1
FDNS	16ALL	0	16WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200	200	0.37256	102.7365	NESET 4 230.00 () 230/115/13.8KV TRANSFORMER CKT 1
FDNS	16ALL	2	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90563	137.5507	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	2	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90563	137.5507	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	2	20L	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90563	137.5064	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	2	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	126.104	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	2	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	126.104	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	2	20SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	126.0798	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	2	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	120.648	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	2	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	120.6376	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	2	25SP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90566	120.6376	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	16ALL	2	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90564	115.1737	TANDE 3345.00 - TANDE-LNX 345.00 345KV CKT Z
FDNS	16ALL	2	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90564	115.1557	JUDSON 3345.00 - TANDE-LNX 345.00 345KV CKT 1
FDNS	16ALL	2	20WP	G15_046	FROM->TO	NESET 4 230.00 - TIOGA 230KV CKT 1	200.0	200.0	0.90564	115.1557	JUDSON-TANDE-TLINE-REACTORS-CKT1
FDNS	08ALL	0	25SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20279	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19681	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19681	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2035	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19903	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19903	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20181	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	08ALL	0	20WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20124	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20124	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20254	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20442	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20279	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19681	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19681	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2035	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19903	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19903	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20181	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20124	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20124	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20254	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_047	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20442	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	1022	1124	0.24669	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	987.2	1082.8	0.19019	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	1792	1972	0.1856	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	1792	1792	0.1856	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	439	439	0.11583	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_056		Non-Converged Contingency	329.05	360.92	0.09441	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_056		Non-Converged Contingency	956	1042	0.24516	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	956	1042	0.21697	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	956	1042	0.21697	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	1792	1972	0.17776	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	1792	1972	0.17776	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	1792	1792	0.17776	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	956.1	1051.7	0.15124	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_056		Non-Converged Contingency	956.1	1051.7	0.15124	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_056		Non-Converged Contingency	956	1042	0.25093	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_056		Non-Converged Contingency	1792	1792	0.202	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	1022	1124	0.24504	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	1792	1972	0.19758	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	1792	1792	0.19758	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	987.2	1082.8	0.17508	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	560	560	0.17508	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_056		Non-Converged Contingency	421	439	0.09923	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	16WP	G15_056	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	329.05	360.92	0.20427	103.7085	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.09923	102.1609	System Intact
FDNS	06ALL	0	17G	G15_056	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.11192	101.6182	System Intact
FDNS	06ALL	0	20L	G15_056	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.08313	100.7218	System Intact
FDNS	06ALL	0	20SP	G15_056	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	318.7	350.6	0.19599	102.2907	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	06ALL	0	17SP	G15_056	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	318.7	350.6	0.2194	99.1	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	06ALL	0	17G	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09129	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.08103	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09441	118.487	System Intact
FDNS	06ALL	0	20L	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.06751	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09246	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_056	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.0839	105.1284	System Intact
FDNS	06ALL	0	17G	G15_056	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.09468	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_056	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.08396	110.0553	System Intact
FDNS	06ALL	0	20L	G15_056	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.07028	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_056	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.09797	104.6951	System Intact
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	115.2081	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	115.2019	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	115.1855	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	112.3278	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	112.3228	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20379	112.3087	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20458	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20458	105.6849	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20458	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.20458	104.4585	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	17G	G15_056	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.11192	110.8124	System Intact
FDNS	06ALL	0	20L	G15_056	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.08313	104.1613	System Intact
FDNS	06ALL	0	17G	G15_056	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.11192	109.0736	System Intact
FDNS	06ALL	0	20L	G15_056	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.08313	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41015	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41015	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41015	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41015	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.23066	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.23066	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.39906	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.21048	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.21048	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.21048	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.21048	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.23066	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.23066	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_056	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.39906	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41015	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41015	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41015	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41015	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.23066	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.23066	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.39906	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.21048	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.21048	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.21048	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.21048	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.23066	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.23066	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_056	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.39906	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_056	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.24071	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_056	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.22447	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_056	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23596	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.24355	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.28491	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.25563	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.25595	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.27956	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_056	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.25071	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28364	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28364	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27854	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25622	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27854	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.25622	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28621	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28621	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28974	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28974	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28511	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_056	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28511	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	1022	1124	0.24996	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	1792	1972	0.18876	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	1792	1792	0.18876	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	987.2	1082.8	0.18758	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	439	439	0.11429	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_058		Non-Converged Contingency	329.05	360.92	0.09315	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_058		Non-Converged Contingency	956	1042	0.24889	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	956	1042	0.22876	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	956	1042	0.22876	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	1792	1972	0.189	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	1792	1972	0.189	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	1792	1792	0.189	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	956.1	1051.7	0.14199	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_058		Non-Converged Contingency	956.1	1051.7	0.14199	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_058		Non-Converged Contingency	956	1042	0.26272	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_058		Non-Converged Contingency	1792	1792	0.21324	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	1022	1124	0.25683	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	1792	1972	0.20882	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	1792	1792	0.20882	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	987.2	1082.8	0.16583	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	560	560	0.16583	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_058		Non-Converged Contingency	421	439	0.09371	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	16WP	G15_058	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	329.05	360.92	0.19942	103.7085	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20WP	G15_058	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.09371	102.1609	System Intact
FDNS	06ALL	0	17G	G15_058	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.11039	101.6182	System Intact
FDNS	06ALL	0	20L	G15_058	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.07761	100.7218	System Intact
FDNS	06ALL	0	17SP	G15_058	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	318.7	350.6	0.20362	99.1	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	06ALL	0	17G	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09003	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.07651	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09315	118.487	System Intact
FDNS	06ALL	0	20L	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.06299	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.09103	111.5204	System Intact

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	20SP	G15_058	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07938	105.1284	System Intact
FDNS	06ALL	0	17G	G15_058	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.09338	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_058	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.07929	110.0553	System Intact
FDNS	06ALL	0	20L	G15_058	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.06562	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_058	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.09667	104.6951	System Intact
FDNS	06ALL	0	17G	G15_058	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.11039	110.8124	System Intact
FDNS	06ALL	0	20L	G15_058	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.07761	104.1613	System Intact
FDNS	06ALL	0	17G	G15_058	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.11039	109.0736	System Intact
FDNS	06ALL	0	20L	G15_058	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.07761	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41625	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41625	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41625	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.41625	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.40516	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_058	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.40516	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41625	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41625	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41625	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.41625	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.40516	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_058	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.40516	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_058	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.24235	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_058	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23021	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_058	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23759	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.25907	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.32202	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.29272	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.27365	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.31667	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_058	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.26623	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29262	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29262	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28302	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.26520	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28302	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.26520	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29070	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29070	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29872	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29872	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29023	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_058	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29023	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20872	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20312	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20312	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20943	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20534	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20534	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20822	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24195	112.5718	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24235	109.7811	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	109.3374	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20716	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20716	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	107.0409	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20895	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	104.8606	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2143	104.4947	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21034	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	102.9285	917X
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	102.6793	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21601	102.1691	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24664	102.134	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20752	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20752	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	100.5479	917X
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2143	100.1426	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20872	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20312	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20312	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20943	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20534	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20534	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20822	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24195	112.5718	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24235	109.7811	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	109.3374	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20716	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20716	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	107.0409	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20895	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	104.8606	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2143	104.4947	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21034	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.19623	102.9285	917X
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	102.6793	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	25SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21601	102.1691	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.24664	102.134	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20752	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.20752	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.21269	100.5479	917X
FDNS	08ALL	0	17G	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2143	100.1426	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_062	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.2146	99	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58145	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56444	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56444	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58215	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56666	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56666	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56959	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56143	113.4784	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56143	113.3597	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63083	112.5718	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63123	109.7811	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	109.3374	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57961	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57961	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	107.0409	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57032	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	104.8606	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60444	104.4947	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58279	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	102.9285	917X
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	102.6793	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59015	102.3882	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59015	102.3882	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.61428	102.1691	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63553	102.134	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.55767	101.988	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59627	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59627	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	100.5479	917X
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60444	100.1426	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58145	124.0172	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56444	120.0648	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56444	120.0067	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58215	116.374	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56666	115.689	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56666	115.6629	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56959	114.3481	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56143	113.4784	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.56143	113.3597	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63083	112.5718	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63123	109.7811	VIOLA 7 345.00 - WICHITA 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	109.3374	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57961	108.5199	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57961	108.4264	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	107.0409	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.57032	106.6874	SOONER - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	104.8606	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60444	104.4947	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	20SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.58279	103.2037	NORTHWEST - SPRING CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59423	102.9285	917X
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	102.6793	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59015	102.3882	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	20L	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59015	102.3882	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	25SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.61428	102.1691	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.63553	102.134	VIOLA 7 345.00 - WICHITA 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.55767	101.988	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59627	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.59627	101.1615	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	08ALL	0	16WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60283	100.5479	917X
FDNS	08ALL	0	17G	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.60444	100.1426	G15066_T 345.00 - SOONER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_063	FROM->TO	G15063_T 345.00 - MATHWSN7 345.00 345KV CKT 1	956	956	0.6126	99	CLEVELAND - G15066_T 345.00 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	1022	1124	0.32639	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	1792	1972	0.26252	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	1792	1792	0.26252	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	987.2	1082.8	0.12781	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	439	439	0.07771	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_068		Non-Converged Contingency	329.05	360.92	0.06321	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_068		Non-Converged Contingency	956	1042	0.32265	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	956	1042	0.27531	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	956	1042	0.27531	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	1792	1972	0.23336	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	1792	1972	0.23336	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	1792	1792	0.23336	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	956.1	1051.7	0.10569	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_068		Non-Converged Contingency	956.1	1051.7	0.10569	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_068		Non-Converged Contingency	956	1042	0.30928	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_068		Non-Converged Contingency	1792	1792	0.25762	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	1022	1124	0.3034	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	1792	1972	0.25319	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	1792	1792	0.25319	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	987.2	1082.8	0.12952	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	560	560	0.12952	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_068		Non-Converged Contingency	421	439	0.07181	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_068	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.07181	102.1609	System Intact
FDNS	06ALL	0	17G	G15_068	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.0738	101.6182	System Intact
FDNS	06ALL	0	20L	G15_068	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.05572	100.7218	System Intact
FDNS	06ALL	0	17G	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.0601	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.05859	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.06321	118.487	System Intact
FDNS	06ALL	0	20L	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.04507	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.06226	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_068	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.06146	105.1284	System Intact
FDNS	06ALL	0	17G	G15_068	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.06242	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_068	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.06075	110.0553	System Intact
FDNS	06ALL	0	20L	G15_068	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.04709	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_068	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.06572	104.6951	System Intact
FDNS	06ALL	0	17G	G15_068	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.0738	110.8124	System Intact
FDNS	06ALL	0	20L	G15_068	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.05572	104.1613	System Intact
FDNS	06ALL	0	17G	G15_068	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.0738	109.0736	System Intact
FDNS	06ALL	0	20L	G15_068	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.05572	102.5031	System Intact
FDNS	06ALL	2	16WP	G15_068	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.27561	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_068	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.25201	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_068	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.27086	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.45325	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.43664	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.40724	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.45418	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.43129	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_068	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.46041	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.31589	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.31589	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32263	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28845	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32263	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28845	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33031	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33031	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32199	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32199	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32602	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_068	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32602	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	08ALL	0	25SP	G15_069		Non-Converged Contingency	956.09	1051.7	0.03659	-	Hitchland Interchange - WALKTAP7 345.00 345KV CKT 1
FDNSLock-Blown up	08ALL	0	25SP	G15_069		Non-Converged Contingency	956.09	1051.7	0.03286	-	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24997	121.7232	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23466	119.4138	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24838	110.37	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24883	109.9221	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23328	108.7458	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23286	106.639	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	08ALL	0	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23163	104.992	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.25671	102.8695	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.25192	102.8205	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.21688	101.0066	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24048	100.7857	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23592	100.781	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.19824	100.7205	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24997	121.7232	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23466	119.4138	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24838	110.37	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24883	109.9221	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23328	108.7458	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23286	106.639	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23163	104.992	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.25671	102.8695	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.25192	102.8205	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.21688	101.0066	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.24048	100.7857	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.23592	100.781	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.19824	100.7205	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.24933	121.2526	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	17SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23407	118.958	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.24772	109.9255	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.24845	109.631	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20SP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23292	108.4651	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	17G	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23224	106.2106	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23132	104.6661	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.25158	102.3632	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.25607	102.3393	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20L	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.21658	100.6967	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23561	100.3419	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.23988	100.2713	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	16WP	G15_069	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.19771	100.2293	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40314	116.8006	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40289	109.3342	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.37418	105.3299	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.39875	104.6713	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.37418	100.7589	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40338	100.1205	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.3457	121.7232	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33096	119.4138	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29678	111.5618	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34409	110.37	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34496	109.9221	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32989	108.7458	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.28075	106.9743	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32925	106.639	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32776	104.992	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29677	104.9536	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29678	104.6094	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.35242	102.8695	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34804	102.8205	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29508	101.2213	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.31349	101.0066	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29778	101.0023	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33687	100.7857	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33253	100.781	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.30295	100.7205	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08NR	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.08663	100.2028	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.28075	99.9	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40314	116.8006	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40289	109.3342	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.37418	105.3299	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.39875	104.6713	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.37418	100.7589	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	0	25SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717	717	0.40338	100.1205	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.3457	121.7232	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33096	119.4138	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29678	111.5618	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34409	110.37	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34496	109.9221	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32989	108.7458	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.28075	106.9743	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32925	106.639	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.32776	104.992	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29677	104.9536	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29678	104.6094	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.35242	102.8695	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.34804	102.8205	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29508	101.2213	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.31349	101.0066	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.29778	101.0023	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33687	100.7857	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.33253	100.781	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	0	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.30295	100.7205	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08NR	0	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.08663	100.2028	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	0	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717	717	0.28075	99.9	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.40275	116.435	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.40265	109.102	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.37384	104.9963	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.39838	104.3286	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.37384	100.4291	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	2	25SP	G15_073	FROM->TO	EMPORIA ENERGY CENTER - SWISSVALE 345KV CKT 1	717.0	717.0	0.40319	100	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.34518	121.2526	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.33047	118.958	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.29634	111.1295	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.34354	109.9255	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.34464	109.631	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.32959	108.4651	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.28055	106.6128	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.32873	106.2106	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.32751	104.6661	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	17G	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.29631	104.5338	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	17SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.29634	104.1814	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNS	08ALL	2	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.34777	102.3632	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.35189	102.3393	HOYT - STRANGER CREEK 345KV CKT 1
FDNS	08ALL	2	20SP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.29482	100.9519	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.31326	100.6967	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.29755	100.5765	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	20WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.33228	100.3419	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.33637	100.2713	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1
FDNS	08ALL	2	16WP	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.30251	100.2293	LACYGNE - WAVERLY7 345.00 345KV CKT 1
FDNS	08ALL	2	20L	G15_073	FROM->TO	SWISSVALE - WEST GARDNER 345KV CKT 1	717.0	717.0	0.28055	99.6	WAVERLY7 345.00 - WOLF CREEK 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	1022	1124	0.28364	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	1792	1972	0.22131	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	1792	1792	0.22131	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	987.2	1082.8	0.1608	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	439	439	0.09841	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_075		Non-Converged Contingency	329.05	360.92	0.08016	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_075		Non-Converged Contingency	956	1042	0.27986	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	956	1042	0.24228	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	956	1042	0.24228	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	1792	1972	0.20193	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	1792	1972	0.20193	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	1792	1792	0.20193	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	956.1	1051.7	0.13103	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_075		Non-Converged Contingency	956.1	1051.7	0.13103	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_075		Non-Converged Contingency	956	1042	0.2762	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_075		Non-Converged Contingency	1792	1792	0.22613	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	1022	1124	0.27032	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	1792	1972	0.22171	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	1792	1792	0.22171	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	987.2	1082.8	0.15489	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	560	560	0.15489	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_075		Non-Converged Contingency	421	439	0.0876	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20L	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	111.9034	System Intact
FDNS	06ALL	0	20L	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	109.8558	System Intact
FDNS	06ALL	0	16WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	108.1258	System Intact
FDNS	06ALL	0	20WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	106.9128	System Intact
FDNS	06ALL	0	16WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	106.302	System Intact
FDNS	06ALL	0	20WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	105.4335	System Intact
FDNS	06ALL	0	17G	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	103.6309	System Intact
FDNS	06ALL	0	17G	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	102.0574	System Intact
FDNS	06ALL	0	17SP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	99.8	System Intact
FDNS	06ALL	0	20SP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1	99.7	System Intact
FDNS	06ALL	0	20WP	G15_075	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.0876	102.1609	System Intact
FDNS	06ALL	0	17G	G15_075	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.0945	101.6182	System Intact
FDNS	06ALL	0	20L	G15_075	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.07148	100.7218	System Intact

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	17G	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07704	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.07152	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.08016	118.487	System Intact
FDNS	06ALL	0	20L	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.05798	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07915	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_075	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07439	105.1284	System Intact
FDNS	06ALL	0	17G	G15_075	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.07994	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_075	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.07412	110.0553	System Intact
FDNS	06ALL	0	20L	G15_075	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.06043	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_075	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.08323	104.6951	System Intact
FDNS	06ALL	0	17G	G15_075	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.0945	110.8124	System Intact
FDNS	06ALL	0	20L	G15_075	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.07148	104.1613	System Intact
FDNS	06ALL	0	17G	G15_075	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.0945	109.0736	System Intact
FDNS	06ALL	0	20L	G15_075	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.07148	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.47909	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.47909	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.47909	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.47909	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.3959	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.3959	106.9114	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.468	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.37582	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.37582	106.1248	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.37582	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.37582	103.7641	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.3959	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.3959	103.3947	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_075	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.468	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.47909	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.47909	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.47909	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.47909	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.3959	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.3959	106.9114	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.468	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.37582	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.37582	106.1248	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.37582	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20L	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.37582	103.7641	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.3959	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	20WP	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.3959	103.3947	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_075	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.468	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	20L	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	111.8034	System Intact
FDNS	06ALL	2	20L	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	109.8144	System Intact
FDNS	06ALL	2	16WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	108.4017	System Intact
FDNS	06ALL	2	20WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	106.835	System Intact
FDNS	06ALL	2	16WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	106.4226	System Intact
FDNS	06ALL	2	20WP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	105.4059	System Intact
FDNS	06ALL	2	17G	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	103.7969	System Intact
FDNS	06ALL	2	17G	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	102.1281	System Intact
FDNS	06ALL	2	17SP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	99.7	System Intact
FDNS	06ALL	2	20SP	G15_075	FROM->TO	CARLISLE INTERCHANGE (WH RLP38371) 115/69/13.2KV TRANSFORMER CKT 1	44.37	44.4	1.00000	99.7	System Intact
FDNS	06ALL	2	16WP	G15_075	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.25919	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_075	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23845	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_075	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.25443	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.41354	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.42059	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.39150	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.41491	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.41524	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_075	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.42070	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32696	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32696	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32940	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29960	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.32940	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29960	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33708	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33708	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33306	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33306	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33287	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_075	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.33287	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	1022	1124	0.25407	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	1792	1972	0.19274	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	1792	1792	0.19274	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	987.2	1082.8	0.18431	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	439	439	0.11235	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_079		Non-Converged Contingency	329.05	360.92	0.09156	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_079		Non-Converged Contingency	956	1042	0.25352	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	956	1042	0.23633	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	956	1042	0.23633	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	1792	1972	0.19622	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	1792	1972	0.19622	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	1792	1792	0.19622	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	956.1	1051.7	0.13605	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_079		Non-Converged Contingency	956.1	1051.7	0.13605	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_079		Non-Converged Contingency	956	1042	0.27029	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_079		Non-Converged Contingency	1792	1792	0.22046	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	1022	1124	0.2644	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	1792	1972	0.21604	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	1792	1792	0.21604	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	987.2	1082.8	0.15989	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	560	560	0.15989	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_079		Non-Converged Contingency	421	439	0.09017	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_079	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.09017	102.1609	System Intact
FDNS	06ALL	0	17G	G15_079	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.10844	101.6182	System Intact
FDNS	06ALL	0	20L	G15_079	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.07407	100.7218	System Intact
FDNS	06ALL	0	17SP	G15_079	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	318.7	350.6	0.1962	99.1	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	06ALL	0	17G	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08845	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.07362	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09156	118.487	System Intact
FDNS	06ALL	0	20L	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.0601	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08925	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_079	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07649	105.1284	System Intact
FDNS	06ALL	0	17G	G15_079	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.09173	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_079	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.0763	110.0553	System Intact
FDNS	06ALL	0	20L	G15_079	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.06262	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_079	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.09503	104.6951	System Intact
FDNS	06ALL	0	17G	G15_079	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.10844	110.8124	System Intact
FDNS	06ALL	0	20L	G15_079	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.07407	104.1613	System Intact
FDNS	06ALL	0	17G	G15_079	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.10844	109.0736	System Intact
FDNS	06ALL	0	20L	G15_079	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.07407	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.41285	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_079	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.41285	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.41285	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_079	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.41285	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_079	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.24441	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_079	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23397	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_079	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23965	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.27739	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.34767	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.31837	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.29437	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.34231	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_079	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.28454	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29950	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29950	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28871	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27208	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28871	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27208	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29639	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29639	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.30560	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.30560	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29661	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_079	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29661	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	1022	1124	0.25407	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	1792	1972	0.19274	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	1792	1792	0.19274	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	987.2	1082.8	0.18431	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	439	439	0.11235	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_080		Non-Converged Contingency	329.05	360.92	0.09156	-	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNSLock-Blown up	06ALL	0	17SP	G15_080		Non-Converged Contingency	956	1042	0.25352	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	956	1042	0.23633	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	956	1042	0.23633	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	1792	1972	0.19622	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	1792	1972	0.19622	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	1792	1792	0.19622	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	956.1	1051.7	0.13605	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20L	G15_080		Non-Converged Contingency	956.1	1051.7	0.13605	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_080		Non-Converged Contingency	956	1042	0.27029	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20SP	G15_080		Non-Converged Contingency	1792	1792	0.22046	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	1022	1124	0.2644	-	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	1792	1972	0.21604	-	BORDER 7345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	1792	1792	0.21604	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	987.2	1082.8	0.15989	-	Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	560	560	0.15989	-	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_080		Non-Converged Contingency	421	439	0.09017	-	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	06ALL	0	20WP	G15_080	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.09017	102.1609	System Intact
FDNS	06ALL	0	17G	G15_080	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	439	439	0.10844	101.6182	System Intact
FDNS	06ALL	0	20L	G15_080	TO->FROM	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1	421	439	0.07407	100.7218	System Intact
FDNS	06ALL	0	17SP	G15_080	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1	318.7	350.6	0.1962	99.1	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	06ALL	0	17G	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08845	128.3977	System Intact
FDNS	06ALL	0	20WP	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.07362	125.1597	System Intact
FDNS	06ALL	0	16WP	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329.05	360.92	0.09156	118.487	System Intact
FDNS	06ALL	0	20L	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.0601	114.3886	System Intact
FDNS	06ALL	0	17SP	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.08925	111.5204	System Intact
FDNS	06ALL	0	20SP	G15_080	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	318.7	350.57	0.07649	105.1284	System Intact
FDNS	06ALL	0	17G	G15_080	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.09173	115.3378	System Intact
FDNS	06ALL	0	20WP	G15_080	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.0763	110.0553	System Intact
FDNS	06ALL	0	20L	G15_080	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	318.7	350.57	0.06262	107.1826	System Intact
FDNS	06ALL	0	16WP	G15_080	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329.05	360.92	0.09503	104.6951	System Intact
FDNS	06ALL	0	17G	G15_080	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.10844	110.8124	System Intact
FDNS	06ALL	0	20L	G15_080	FROM->TO	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348.58	381.24	0.07407	104.1613	System Intact
FDNS	06ALL	0	17G	G15_080	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.10844	109.0736	System Intact
FDNS	06ALL	0	20L	G15_080	FROM->TO	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.07407	102.5031	System Intact
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	115.2439	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	700	0.42393	108.7706	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.41285	106.716	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	17G	G15_080	FROM->TO	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1	560	644	0.41285	100.9369	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	115.2439	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	16WP	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	616	700	0.42393	108.7706	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.41285	106.716	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G15_080	FROM->TO	TUCO INTERCHANGE (SIEM 8743066) 345/230/13.2KV TRANSFORMER CKT 2	560	644	0.41285	100.9369	TUCO INTERCHANGE (GE M1022338) 345/230/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	2	16WP	G15_080	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.24441	102.9298	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_080	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23397	101.9768	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_080	TO->FROM	CIMARRON - MINCO 345KV CKT 1	956.0	956.0	0.23965	101.8472	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	06ALL	2	17G	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.27739	127.3384	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.34767	126.6863	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.31837	124.9834	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	497.0	547.0	0.29437	118.5791	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.34231	115.9185	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_080	TO->FROM	CRAWFISH_DR 230.00 - TUCO INTERCHANGE 230KV CKT 1	552.0	608.0	0.28454	103.1744	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29950	145.7209	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20WP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29950	141.9228	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28871	136.5816	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27208	135.9497	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17G	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.28871	133.7208	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20L	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.27208	133.1443	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29639	129.9666	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	16WP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29639	127.9259	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.30560	124.3166	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	20SP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.30560	122.5708	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29661	120.9427	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	06ALL	2	17SP	G15_080	FROM->TO	CRAWFISH_DR 345.00 (CRAWFISH_DR) 345/230/13.2KV TRANSFORMER CKT 1	560.0	560.0	0.29661	119.5043	CRAWFISH_DR 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	16ALL	0	25SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05731	111.2462	System Intact
FDNS	16ALL	0	25SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05731	110.5475	System Intact
FDNS	16ALL	0	20SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05723	102.9378	System Intact

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	16ALL	0	16WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05771	101.8878	System Intact
FDNS	16ALL	0	20SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05723	101.5439	System Intact
FDNS	16ALL	0	16WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05771	100.9745	System Intact
FDNS	16ALL	0	20WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05702	100.4127	System Intact
FDNS	16ALL	0	20WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05702	100.1377	System Intact
FDNS	16ALL	2	25SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05731	111.2462	System Intact
FDNS	16ALL	2	25SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05731	110.5475	System Intact
FDNS	16ALL	2	20SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05723	102.9378	System Intact
FDNS	16ALL	2	20SP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05723	101.5439	System Intact
FDNS	16ALL	2	20WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05702	100.4127	System Intact
FDNS	16ALL	2	20WP	G15_096	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05702	100.1377	System Intact
FDNS	16ALL	0	25SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05139	111.2462	System Intact
FDNS	16ALL	0	25SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05139	110.5475	System Intact
FDNS	16ALL	0	20SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05131	102.9378	System Intact
FDNS	16ALL	0	16WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05177	101.8878	System Intact
FDNS	16ALL	0	20SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05131	101.5439	System Intact
FDNS	16ALL	0	16WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.05177	100.9745	System Intact
FDNS	16ALL	0	20WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.0511	100.4127	System Intact
FDNS	16ALL	0	20WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100	125	0.0511	100.1377	System Intact
FDNS	16ALL	2	25SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05139	111.2462	System Intact
FDNS	16ALL	2	25SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05139	110.5475	System Intact
FDNS	16ALL	2	20SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05131	102.9378	System Intact
FDNS	16ALL	2	20SP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05131	101.5439	System Intact
FDNS	16ALL	2	20WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05110	100.4127	System Intact
FDNS	16ALL	2	20WP	G15_098	FROM->TO	DICKINSON (KW1A 100) 230/115/13.8KV TRANSFORMER CKT 1	100.0	125.0	0.05110	100.1377	System Intact

11.8 G-V: Voltage Power Flow Analysis (Constraints Requiring Transmission Reinforcement)

Available upon request. Contact SPP Generation Interconnection Studies for details.

11.9 H-T: Thermal Power Flow Analysis (Other Constraints Not Requiring Transmission Reinforcement)

Available upon request. Contact SPP Generation Interconnection Studies for details.

11.10 H-T-AS: Affected System Thermal Power Flow Analysis (Constraints for Potential Upgrades)

Available upon request. Contact SPP Generation Interconnection Studies for details.

11.11 H-V-AS: Affected System Voltage Power Flow Analysis(Constraints for Potential Upgrades)

Available upon request. Contact SPP Generation Interconnection Studies for details.

11.12 I: Power Flow Analysis (Constraints from Multi-Contingencies)

Available upon request. Contact SPP Generation Interconnection Studies for detail.

11.13 J: Transient Stability Group 6

See next page.

MITSUBISHI ELECTRIC POWER PRODUCTS, INC.
POWER SYSTEMS ENGINEERING SERVICES
530 KEYSTONE DRIVE
WARRENDALE, PA 15086, U.S.A.

Phone: (724) 778-5111 Fax: (724) 778-5149
Home Page: www.meppi.com

Southwest Power Pool, Inc. (SPP)

DISIS-2015-002-4 (Group 06) Definitive Impact Study

Final Report

REP-0125
Revision #00

October 2017

Submitted By:
Mitsubishi Electric Power Products, Inc. (MEPPI)
Power Systems Engineering Division
Warrendale, PA

Title:	**DISIS-2015-002-4 (Group 06) Definitive Impact Study: Final Report REP-0125**	
Date:	October 2017	
Author:	GianMarco Alian; Engineer I, Power Systems Engineering Dept.	*Gianmarco Alian*
Reviewed:	Nicholas W. Tenza; Engineer II, Power Systems Engineering Dept.	*Nicholas W. Tenza*
Approved:	Rajat Majumder; Section Manager, Power Systems Engineering Dept.	*Rajat Majumder*

EXECUTIVE SUMMARY

SPP requested a Definitive Interconnection System Impact Study (DISIS). The DISIS required a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, and Low Wind/No Wind Analysis detailing the impacts of the interconnecting projects as shown in Table ES-1.

Table ES-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-020	100.0	Eaton Power Xpert Solar 1.67MW (584623) (solar)	Oasis 115kV (524874)
GEN-2015-031	150.53	GE 1.79 MW (wind)	Swisher (525213) to Amarillo South (524415) 230 kV (560050)
GEN-2015-056	101	GE 2.3 MW (wind)	Crossroads 345kV (527656) (Tap Eddy (527802) to Tolk(525549)
GEN-2015-058	50	TMEIC Solar Ware Samurai 1833 1.667 MW inverter (solar)	Atoka 115kV (527786)
GEN-2015-068	300	GE 2.0 MW (wind)	Tuco 345kV (525832)
GEN-2015-075	50	GE 4.0MVA Inverter (solar)	Carlisle 69kV (526159)
GEN-2015-079	129.2	GE LV5 3.8 MW (solar)	Tap Yoakum (526935) to Hobbs (527894) 230 kV (560059)
GEN-2015-080	129.2	GE LV5 3.8 MW (solar)	Tap Yoakum (526935) to Hobbs (527894) 230 kV (560059)

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined that there were multiple contingencies across all seasons that resulted in system/voltage instability, generation tripping offline, and poor post-fault voltage recovery when all generation interconnection requests were at 100% output.

To mitigate the system/voltage instability, voltage violations, generation tripping offline, and poor post-fault steady-state voltages, the following upgrades were provided by SPP and implemented in each season:

- OKU Reactive Power Support
  - 2 x 50 Mvar switched shunts
- Crawfish Draw Substation
  - Tap Tuco – Border 345 kV
  - Tap Tuco – Swisher 230 kV
  - Crawfish Draw 345/230 kV transformer
- Tuco – Crawfish Draw – Border 345 kV circuit #2
  - Reroute Yoakum – Tuco to Yoakum – Crawfish Draw
- Border – Chisholm 345 kV circuit #1 and #2

After implementing the above upgrades, the contingency analysis was re-simulated for all contingencies. With the upgrades, the Stability Analysis determined that there was no generation tripping or system instability observed as a result of interconnecting all study projects at 100% output.

SUMMARY OF THE SHORT CIRCUIT ANALYSIS

The Short Circuit Analysis was performed on the 2017 Summer Peak (17SP) and 2025 Summer Peak (25SP) power flows for all study projects. Refer to Table ES-2 and Table ES-3 for a list of maximum fault currents observed for each study project for the 17SP and 25SP cases, respectively.

Table ES-2
2017SP: List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-020	9.37	25.46	Tolk East/West	230
GEN-2015-031	8.94	30.45	Nichols	115
GEN-2015-056	4.87	24.33	Cunningham	115
GEN-2015-058	5.94	24.33	Cunningham	115
GEN-2015-068	10.63	30.41	LP - Cook	69
GEN-2015-075	2.56	25.46	Tolk East	230
GEN-2015-079	8.26	28.22	Hobbs Int	115
GEN-2015-080	8.26	28.22	Hobbs Int	115

Table ES-3
2025SP: List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-020	9.49	26.25	Tolk East/West	230
GEN-2015-031	9.05	34.93	LP - Cook	69
GEN-2015-056	5.47	29.30	Cunningham	115
GEN-2015-058	6.95	29.30	Cunningham	115
GEN-2015-068	12.82	34.93	LP - Cook	69
GEN-2015-075	2.57	26.25	Tolk East	230
GEN-2015-079	8.96	32.45	Hobbs Int	115
GEN-2015-080	8.96	32.45	Hobbs Int	115

SUMMARY OF POWER FACTOR ANALYSIS

The upgrades identified in the Stability Analysis were implemented in the power flow cases and utilized for the Power Factor Analysis. Refer to Table ES-4 for the power factor range observed for each study project.

Table ES-4
Summary of Results for the Power Factory Analysis

	Power Factor Range for Each Study Project[1]									
Study Project	16WP		17SP		20SP		20WP		25SP	
GEN-2015-020	-0.991	0.973	-0.999	0.974	0.977	1.000	-0.997	0.977	-0.999	0.974
GEN-2015-031	-0.834	0.975	-0.853	0.999	-0.956	0.980	-0.966	0.999	-0.942	0.987
GEN-2015-056	-0.970	0.999	-0.983	1.000	-0.988	0.999	-0.978	0.999	-0.986	0.999
GEN-2015-058	-0.940	0.971	-0.947	0.975	-0.999	0.976	-0.992	0.990	-0.969	0.972
GEN-2015-068	-0.737	-0.891	-0.889	-0.984	-0.960	1.000	-0.914	-0.995	-0.976	1.000
GEN-2015-075	0.986	1.000	0.994	1.000	-0.994	1.000	0.996	1.000	0.990	1.000
GEN-2015-079	-0.996	0.982	-0.972	0.982	-0.999	0.982	0.985	1.000	-0.990	0.958
GEN-2015-080	-0.996	0.982	-0.972	0.982	-0.999	0.982	0.985	1.000	-0.990	0.958

[1] Lagging power factors are negative and leading power factors are positive

SUMMARY OF LOW WIND/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for each wind and solar powered interconnection request for each season. The maximum reactance needed for zero Mvar flow was 58 Mvar for GEN-2015-068 (Tuco 345 kV). The minimum reactance needed for zero Mvar flow was 0.4 Mvar for GEN-2015-058 (Atoka 115 kV).

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SECTION 1: OBJECTIVES

The objective of this report is to provide Southwest Power Pool, Inc. (SPP) with the deliverables for the "DISIS-2015-002-4 (Group 06) Definitive Impact Study." SPP requested an Interconnection System Impact Study for eight (8) generation interconnections for 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak, which requires a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, Low Wind/No Wind Analysis, and an Impact Study Report.

SECTION 2: BACKGROUND

The Siemens Power Technologies International PSS/E power system simulation program Version 32.2.0 was used for this study. SPP provided the stability database cases for 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions and a list of contingencies to be examined. The model includes the study projects shown in Table 2-1 and the previously queued projects listed in Table 2-2. Refer to Appendix A for the steady-state and dynamic model data for the study projects. A power flow one-line diagram for each generation interconnection project is shown in Figures 2-1 through 2-7. Note that the one-line diagrams represent the 2017 Summer Peak case.

The Stability Analysis determined the impacts of the new interconnecting projects on the stability and voltage recovery of the nearby system and the ability of the interconnecting projects to meet FERC Order 661A. SPP Performance Criteria violations for stability and voltage recovery were identified, the need for reactive compensation or system upgrades was investigated. Three-phase faults and single line-to-ground faults were examined as listed in Table 2-3.

A Short Circuit Analysis was performed on the 2017 Summer Peak and 2025 Summer Peak study years for each study generator. The study was performed five buses out from the study generator's point of interconnection and results were documented.

The Power Factor Analysis determined the power factor at the point of interconnection for the wind or solar interconnection projects for pre-contingency and post-contingency conditions. Table 2-3 lists the contingencies developed from the three-phase fault definitions provided in the group's interconnection impact study request.

The Low Wind/No Wind Analysis was completed for all wind farm and solar farm interconnections. This analysis determined the reactive support required to have a Mvar flow of approximately zero at the point of interconnection (POI).

Table 2-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-020	100.0	Eaton Power Xpert Solar 1.67MW (584623) (solar)	Oasis 115kV (524874)
GEN-2015-031	150.53	GE 1.79 MW (wind)	Swisher (525213) to Amarillo South (524415) 230 kV (560050)
GEN-2015-056	101	GE 2.3 MW (wind)	Crossroads 345kV (527656) (Tap Eddy (527802) to Tolk(525549)
GEN-2015-058	50	TMEIC Solar Inverter 1.667 MW (solar) (584963)	Atoka 115kV (527786)
GEN-2015-068	300	GE 2.0 MW (wind)	Tuco 345kV (525832)
GEN-2015-075	50	GE 4.0MVA Inverter (solar)	Carlisle 69kV (526159)
GEN-2015-079	129.2	GE LV5 3.8 MW (solar)	Tap Yoakum (526935) to Hobbs (527894) 230 kV (560059)
GEN-2015-080	129.2	GE LV5 3.8 MW (solar)	Tap Yoakum (526935) to Hobbs (527894) 230 kV (560059)

Table 2-2
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2001-033	180	Mitsubishi 1000	San Juan Mesa 230kV (524885)
GEN-2001-036	80	Mitsubishi 1000	Norton 115kV (524502)
GEN-2006-018	170	GENSAL	Tuco 230kV (525830)
GEN-2006-026	502	GENROU (527901, 527902, 527903)	Hobbs 115kV(527891) Hobbs 230kV (527894)
GEN-2008-022	300	Vestas	Tap on Eddy County – Tolk 345kV line (G08-022-POI, 560007)
GEN-2010-006	180 Summer 205 Winter	GENROU	Jones_bus2 230kV(526337)
ASGI-2010-010	42	GENSAL	Lovington 115kV (528334)
ASGI-2010-020	30	GE 2.3 MW (wind)	Tap LE-Tatum to LE-Crsroads 69kV (AS10-020-POI, 560360)
ASGI-2010-021	15	Mitsubishi MPS-1000A 1.0MW	Tap LE-Saundrtp to LE-Anderson 69kV (ASGI-021-POI, 560364)
GEN-2010-046	56	GENSAL	Antelope 230 kV (525840)
ASGI-2011-001	27.3	Suzlon 2.1MW	Lovington 115kV (528334)
ASGI-2011-003	10	Sany 2.0MW	Hendricks 69kV (525943)
ASGI-2011-004	19.8	Sany 1.8MW	Crosby 69kV (525915)
GEN-2011-025	80	GE 1.79 MW	Tap on Floyd County - Crosby County 115kV line (G11-025-POI, 562004)
GEN-2011-045	180 Summer 205 Winter	GENROU	Jones_bus2 230kV (526337)
GEN-2011-046	23 Summer 27 Winter	GENROU	Quay County 115kV (524472)
GEN-2011-048	165 Summer 175 Winter	GENROU	Mustang 230kV (527151)
GEN-2012-001	61.2	CCWE 3.6MW (WT4)	Tap Grassland to Borden 230kV (526679)
ASGI-2012-002	18	Vestas 1.65MW V82	Clovis 115kV (524808)
GEN-2012-020	478	GE 1.68MW	Tuco 230kV (525830)

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2012-034	7 MW increase (Pgen=157MW)	GENROU	Mustang 230kV (527151)
GEN-2012-035	7 MW increase (Pgen=157MW)	GENROU	Mustang 230kV (527151)
GEN-2012-036	7 MW increase (Pgen=172MW Summer/185 MW Winter)	GENROU	Mustang 230kV (527151)
GEN-2012-037	196 Summer 203 Winter	GENROU	Tuco 345kV (525832)
ASGI-2012-002	18	Vestas 1.65MW V82	Clovis 115kV (524808)
GEN-2013-016	191 Summer 203 Winter	GENROU (583456)	Tuco 345kV (525832)
ASGI-2013-002	18.4	Siemens 2.3MW VS (583613)	Tucumcari 115kV (524509)
ASGI-2013-003	18.4	Siemens 2.3MW VS (583623)	Clovis 115kV (524808)
ASGI-2013-005	19.8	Vestas V82 1.65MW (583283)	FE-Clovis 115kV (524808)
ASGI-2013-006	2.0	Gamesa G114 2MW (583813)	Wolforth 115kV (526483)
GEN-2013-022	25.0	SMA SC-2200-US 2.200MW Solar Inverters (583313)	Caprock 115kV (524486)
GEN-2013-027	150.0	V126 GS 3.45 MW	Tap on Yoakum to Tolk 230kV (562480)

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2014-012	186 Summer 225 Winter	GENROU (528607)	Tap Hobbs (527894 in 2015SP/WP, 527896 in 2025SP) to Andrews (528604) 230kV (345kV in 2025SP) (Tap bus is 528611)
ASGI-2014-001	2.3	GE 107m 2.3MW (583816)	Erskine 69kV (526109)
GEN-2014-033	70	GE LV5 4MVA GE LV5 1MVA 1500V Schneider XC680 0.68 Solar Inverter	Chaves County 115kV
GEN-2014-034	70	GE LV5 4MVA 1500V Solar Inverter	Chaves County 115kV
GEN-2014-035	30	GE LV5 4MVA 1500V Solar Inverter	Chaves County 115kV
GEN-2014-047	40	AE 500NX 0.5 MW PV inverters	Tap Tolk - Eddy County (Crossroads) 345kV
GEN-2015-014	150.0	Vestas V110 2.0MW (584563)	Tap on Cochran – LG Plains 115kV (560030)
GEN-2015-022	112.0	GE LV5 4.0MW Inverters (584643)	Swisher 115kV (525212)
ASGI-2015-002	2.0	GE 2.0MW (584723)	Yuma Interchange 115/69kV (526469)

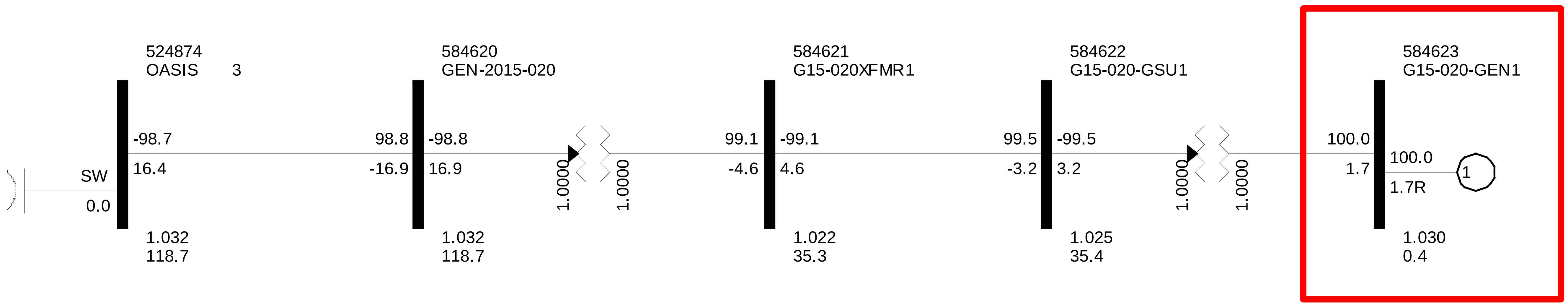


Figure 2-1. Power flow one-line diagram for interconnection project at the Oasis 115 kV POI (GEN-2015-020).

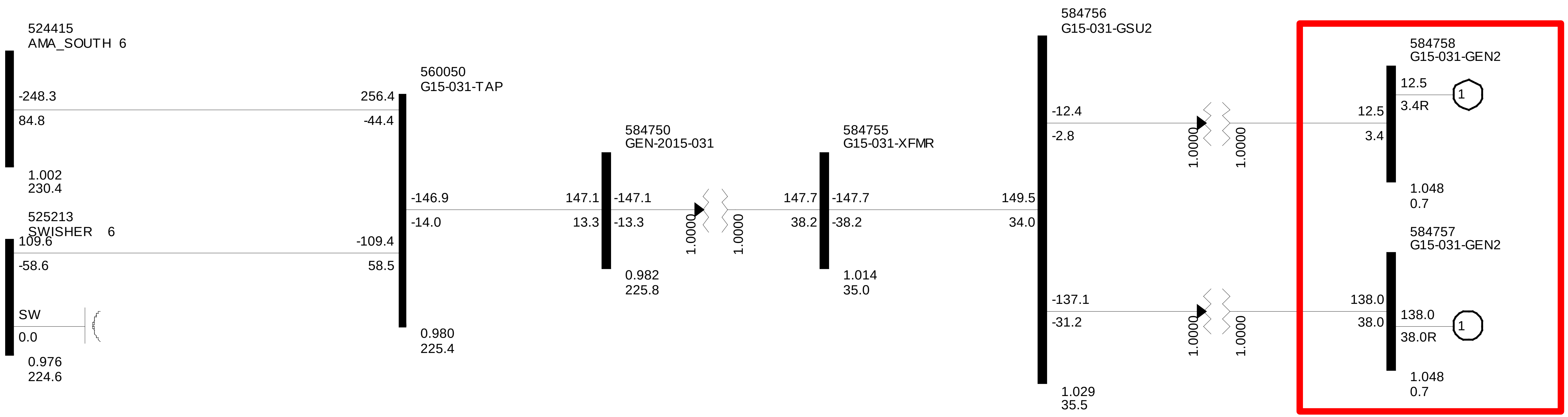


Figure 2-2. Power flow one-line diagram for interconnection project at the Swisher to Amarillo South 230 kV POI (GEN-2015-031).

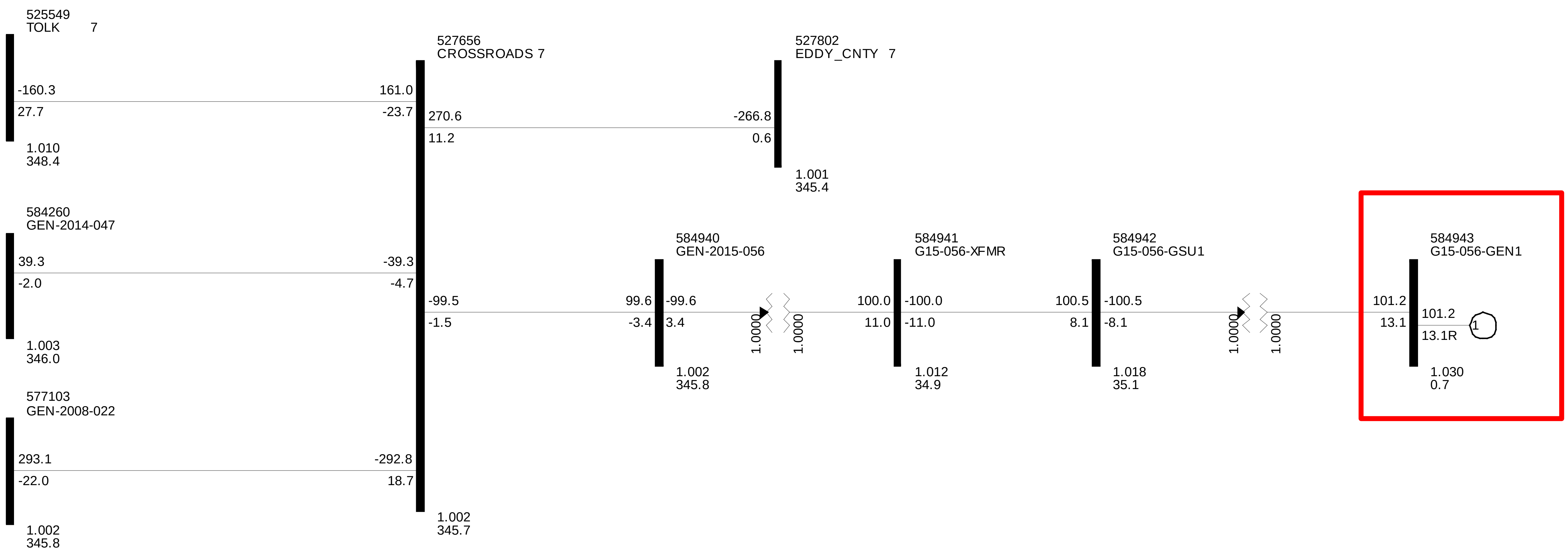


Figure 2-3. Power flow one-line diagram for interconnection project at the Crossroads 345 kV POI (GEN-2015-056).

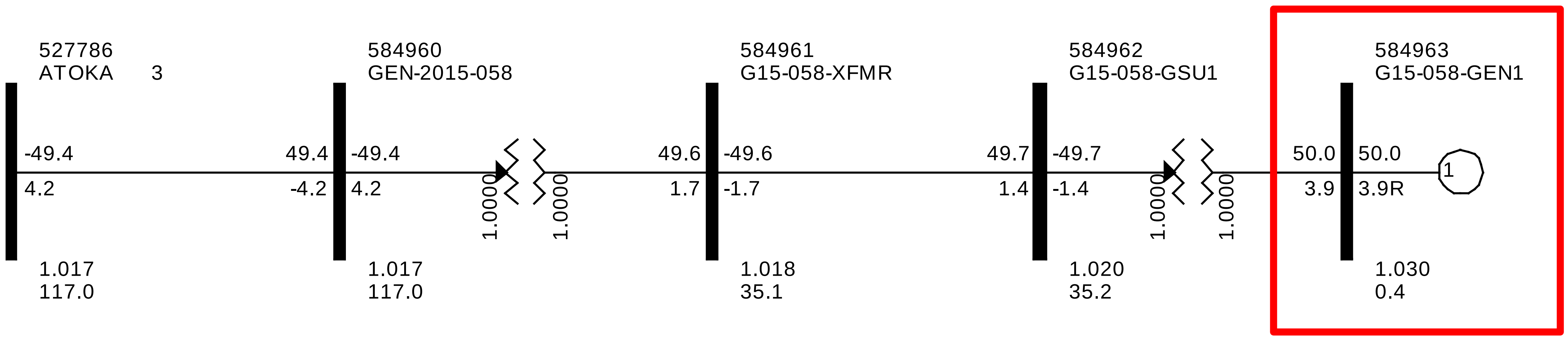


Figure 2-4. Power flow one-line diagram for interconnection project at Atoka 115 kV POI (GEN-2015-058).

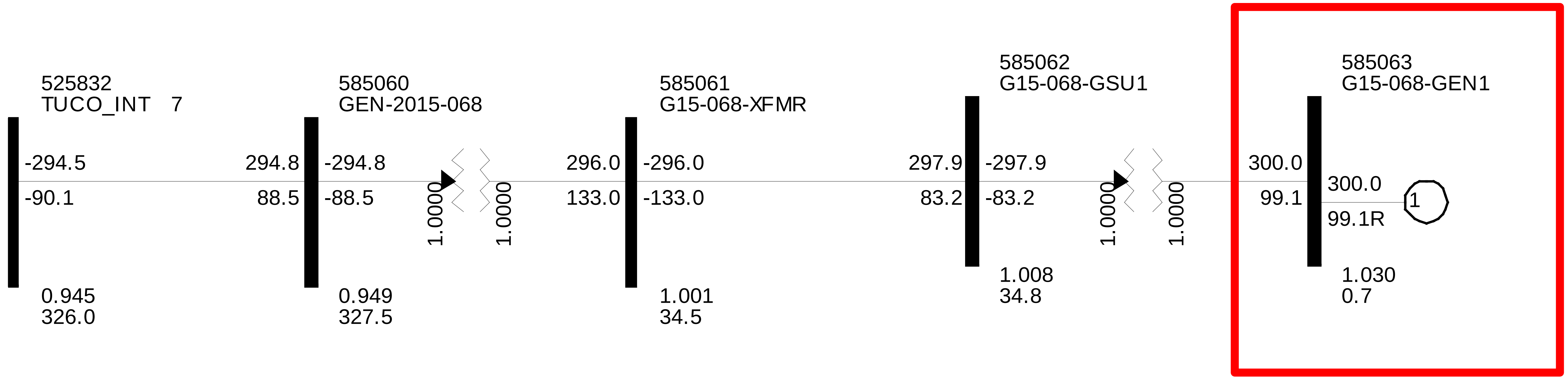


Figure 2-5. Power flow one-line diagram for interconnection project at the Tuco 345 kV POI (GEN-2015-068).

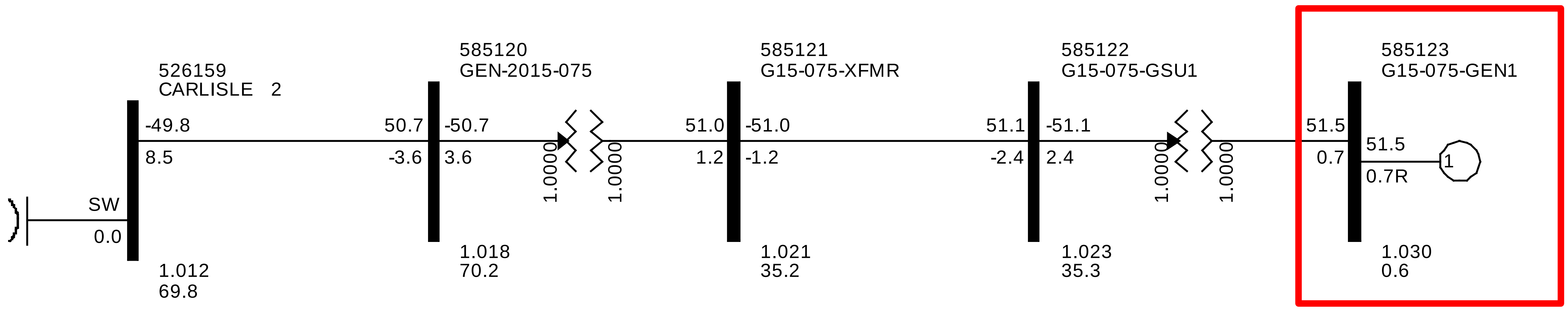


Figure 2-6. Power flow one-line diagram for interconnection project at the Carlisle 69 kV POI (GEN-2015-075).

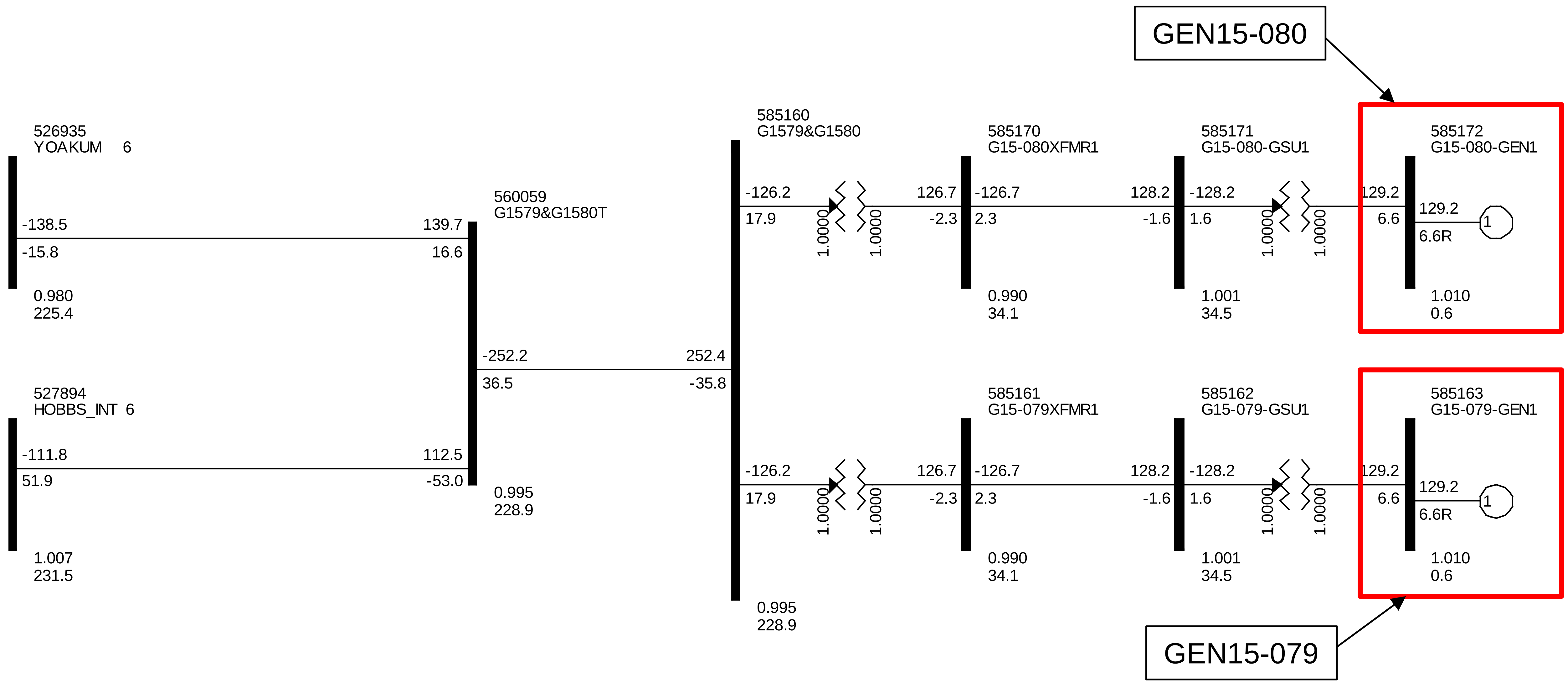


Figure 2-7. Power flow one-line diagram for interconnection project at Yoakum to Hobbs 230 kV POI (GEN-2015-079 and GEN-2015-080).

Table 2-3
Case List with Contingency Description

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on Chaves County 115 kV (527482) to Samson 115 kV (527546) CKT 1, near Chaves County. a. Apply fault at the Chaves County 115 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-3PH	3 phase fault on Chaves County 115 kV (527482) to Urton 115 kV (527501) CKT 1, near Chaves County. a. Apply fault at the Chaves County 115 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT03-3PH	3 phase fault on the Chaves County 115 kV (527482) to Chaves County 230 kV (527483) to Chaves County 13.2 kV (527478) XFMR CKT 1, near Chaves County 115 kV. a. Apply fault at the Chaves County 115 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
4	FLT04-3PH	3 phase fault on Chaves County 230 kV (527483) to San Juan Tap 230 kV (524885) CKT 1, near Chaves County. a. Apply fault at the Chaves County 230 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT05-3PH	3 phase fault on Chaves County 230 kV (527483) to Eddy North 230 kV (527799) CKT 1, near Chaves County. a. Apply fault at the Chaves County 230 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT06-3PH	3 phase fault on Samson 115 kV (527546) to Roswell_Int 115 kV (527564) CKT 1, near Samson. a. Apply fault at the Samson 115 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
7	FLT07-3PH	3 phase fault on Urton 115 kV (527501) to Roswell City 115 kV (527522) CKT 1, near Urton. a. Apply fault at the Urton 115 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
8	FLT10-SB	**Single phase fault with stuck breaker** at **Chaves County (527482)** a. Apply fault at the Chaves 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Chaves County 115 kV (527482)/ 230 kV (527483)/13.2 kV (527479) transformer d. Chaves County (527482) - Samson (527546) 115 kV
9	FLT11-3PH	3 phase fault on the FE-Bailey County (525028) to FE-Curry (524822) 115 kV line circuit 1, near FE-Bailey County. a. Apply fault at the FE-Bailey County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10		DELETED
11	FLT13-3PH	3 phase fault on the FE-Bailey County 115 kV (525028) to Bailey County 2 69 kV (525027) to Bailey transformer 1 13.2 kV (525025) XFMR CKT 1, near FE-Bailey County 115 kV. a. Apply fault at the FE-Bailey County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12	FLT14-3PH	3 phase fault on the FE-Bailey County (525028) to EMU&VLY Tap (525019) 115 kV line circuit 1, near FE-Bailey County. a. Apply fault at the FE-Bailey County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13	FLT15-3PH	3 phase fault on the FE-Curry (524822) to DS#20 (524669) 115 kV line circuit 1, near FE-Curry. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT16-3PH	3 phase fault on the FE-Curry (524822) to Norris Tap (524764) 115 kV line circuit 1, near FE-Curry. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
15	FLT17-3PH	3 phase fault on the FE-Curry (524822) to E_Clovis (524773) 115 kV line circuit 1, near FE-Curry. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
16	FLT18-3PH	3 phase fault on the FE-Curry (524822) to FE_Clovis2 (524838) 115 kV line circuit 1, near FE-Curry. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
17	FLT19-3PH	3 phase fault on the FE-Curry (524822) to Roosevelt (524908) 115 kV line circuit 1, near FE-Curry. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT20-3PH	3 phase fault on the FE-Curry 115 kV (524822) to Curry 69 kV (524821) to Curry 13.2 kV (524819) XFMR CKT 1, near FE-Curry 115 kV. a. Apply fault at the FE-Curry 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
19	FLT21-3PH	3 phase fault on the Oasis (524874) to Perimeter (524797) 115 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT22-3PH	3 phase fault on the Oasis (524874) to FE-Chzplt (524863) 115 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT23-3PH	3 phase fault on the FE-Chzplt (524863) to Norris Tap (524764) 115 kV line circuit 1, near FE-Chzplt. a. Apply fault at the FE-Chzplt 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT24-3PH	3 phase fault on the Perimeter (524797) to Cannon Top (524790)115 kV line circuit 1, near Perimeter. a. Apply fault at the Perimeter 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23	FLT25-3PH	3 phase fault on the Oasis (524874) to Portales (524924) 115 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
24	FLT26-3PH	3 phase fault on the Portales (524924) to Roosevelt (524908) 115 kV line circuit 1, near Oasis. a. Apply fault at the Portales 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT27-3PH	3 phase fault on the Portales 115 kV (524924) to Portales 69 kV (524923) to Portales 13.2 kV (524921) XFMR CKT 1, near Portales 115 kV. a. Apply fault at the Portales 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
26	FLT28-3PH	3 phase fault on the Oasis 115 kV (524874) to Oasis 230 kV (524875) to Oasis 13.2 kV (524872) XFMR CKT 1, near Oasis 115 kV. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
27	FLT29-3PH	3 phase fault on the Oasis (524875) to San Juan Tap (524885) 230 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT30-3PH	3 phase fault on the Oasis (524875) to SW_4k33 (524915) 230 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
29	FLT31-3PH	3 phase fault on the Oasis (524875) to Pleasant Hill (524770) 230 kV line circuit 1, near Oasis. a. Apply fault at the Oasis 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT32-PO	**Prior Outage of the Oasis 115 kV (524874) to Oasis 230 kV (524875) to Oasis 13.2 kV (524872) XFMR CKT 1;** 3 phase fault on the Oasis (524874) to Perimeter (524797) 115 kV line circuit 1, near Oasis 115 kV. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
31	FLT33-PO	**Prior Outage of the Oasis (524874) to Perimeter (524797) 115 kV line circuit 1;** 3 phase fault on the Oasis 115 kV (524874) to Oasis 230 kV (524875) to Oasis 13.2 kV (524872) XFMR CKT 1, near Oasis 115 kV. a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
32	FLT34-3PH	3 phase fault on the Gen-2015-031 Tap (560050) to Amarillo South (524415) 230 kV line circuit 1, near Gen-2015-031 Tap. a. Apply fault at the Gen-2015-031 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
33	FLT35-3PH	3 phase fault on the Gen-2015-031 Tap (560050) to Swisher (525213) 230 kV line circuit 1, near Gen-2015-031 Tap. a. Apply fault at the Gen-2015-031 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT36-3PH	3 phase fault on the Swisher 230 kV (525213) to Swisher 115 kV (525212) to Swisher 13.2 kV (525211) XFMR CKT 1, near Swisher 230 kV. a. Apply fault at the Swisher 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
35	FLT37-3PH	3 phase fault on the Swisher (525213) to Tuco Int (525830) 230 kV line circuit 1, near Swisher. a. Apply fault at the Swisher 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
36	FLT38-3PH	3 phase fault on the Swisher (525213) to Newhart (525461) 230 kV line circuit 1, near Swisher. a. Apply fault at the Swisher 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT39-3PH	3 phase fault on the Amarillo South 230 kV (524415) to Amarillo South 115 kV (524414) to Amarillo South 13.2 kV (524410) XFMR CKT 1, near Amarillo South 230 kV. a. Apply fault at the Amarillo 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
38	FLT40-3PH	3 phase fault on the Amarillo South (524415) to Nichols (524044) 230 kV line circuit 1, near Amarillo South. a. Apply fault at the Amarillo South 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
39	FLT41-3PH	3 phase fault on the Amarillo South (524415) to Randal (524365) 230 kV line circuit 1, near Amarillo South. a. Apply fault at the Amarillo South 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT42-SB	**Single phase fault with stuck breaker at Swisher (525213)** a. Apply fault at the Swisher 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Swisher 230 kV (525213)/ 115 kV (525212)/13.2 kV (525211) transformer d. Swisher (525213) – Tuco2 (560021) 230 kV
41	FLT43-3PH	3 phase fault on the Tuco Int (525832) to OKU (511456) 345 kV line circuit 1, near Rio Blanco. a. Apply fault at the Tuco Int 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 30 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42		DELETED
43	FLT45-3PH	3 phase fault on the Tuco Int (525832) to Border (515458) 345 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT46-3PH	3 phase fault on the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525824) XFMR CKT 1, near Tuco 345 kV bus. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the transformer
45	FLT47-3PH (20WP, 20SP, 25SP)	3 phase fault on the Tuco (525832) to Yoakam (526936) 345 kV line circuit 1, near Tuco. a. Apply fault at the Tuco (525832) 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
46	FLT48-3PH	3 phase fault on the OKU (511456) to Oklaun (599891) 345 kV line circuit 1, near OKU. a. Apply fault at the OKU 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line and remove the fault. c. Block the DC tie at OKU.

Cont. No.	Cont. Name	Description
47	FLT49-3PH	3 phase fault on the OKU (511456) to L.E.S (511468) 345 kV line circuit 1, near OKU. a. Apply fault at the OKU 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
48	FLT50-PO	**Prior Outage of the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525824) XFMR CKT 1;** 3 phase fault on the Tuco 345 kV (525832) to OKU (511456) 345 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
49	FLT51-PO	**Prior Outage of the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525824) XFMR CKT 1;** 3 phase fault on the Tuco Int (525832) to Border (515458) 345 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
50	FLT52-3PH	3 phase fault on the Plant X (525481) to Deaf Smith (524623) 230 kV line circuit 1, near Plant X. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
51	FLT54-3PH	3 phase fault on the Deaf Smith (524623) to Bushland (524267) 230 kV line circuit 1, near Deaf Smith. a. Apply fault at the Deaf Smith 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
52	FLT55-3PH	3 phase fault on the Deaf Smith 230 kV (524623) to Deaf Smith 115 kV (524622) to Deaf Smith 13.2 kV (524620) XFMR CKT 1, near Deaf Smith 230 kV. a. Apply fault at the Deaf Smith 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
53	FLT56-3PH	3 phase fault on the Plant X (525481) to Tolk East (525524) 230 kV line circuit 2, near Plant X. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
54	FLT57-3PH	3 phase fault on the Plant X (525481) to Newhart (525461) 230 kV line circuit 1, near Plant X. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
55	FLT58-3PH	3 phase fault on the Plant X (525481) to Tolk West (525531) 230 kV line circuit 1, near Plant X. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault..
56	FLT59-3PH	3 phase fault on the Plant X (525481) to Sundown (526435) 230 kV line circuit 1, near Plant X. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
57	FLT60-3PH	3 phase fault on the Plant X 230 kV (525481) to Plant X 115 kV (525480) to Plant X 13.2 kV (525479) XFMR CKT 1, near Plant X 230 kV. a. Apply fault at the Plant X 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
58	FLT61-SB	**Single phase fault with stuck breaker** on the Tolk West (525531) to Plant X (525481) 230 kV circuit #1 line, near Tolk West. a. Apply fault at the Tolk West 230 kV bus. b. Run 5 cycles, and then open Plant X end of the faulted line. c. Run 10 cycles, and then clear the fault and disconnect Tolk West 230 kV bus (525531).
59	FLT62-SB	**Single phase fault with stuck breaker** on the Tolk East (525524) to Plant X (525481) 230 kV line circuit #2, near Tolk East. a. Apply fault at the Tolk East 230 kV bus. b. Run 5 cycles, and then open Plant X end of the faulted line. c. Run 10 cycles, and then clear the fault and disconnect Tolk East 230 kV bus (525524).
60	FLT63-3PH	3 phase fault on the Mustang (527149) to Amocowasson (526784) 230 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
61	FLT64-3PH	3 phase fault on the Mustang 230 kV (527149) to Mustang 115 kV (527146) to Mustang 13.2 kV (527143) XFMR CKT 1, near Mustang 230 kV. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
62	FLT65-3PH	3 phase fault on the Mustang (527149) to Yoakum (526935) 230 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
63	FLT66-3PH	3 phase fault on the Mustang (527149) to Seminole (527276) 230 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
64	FLT67-3PH	3 phase fault on the Seminole 230 kV (527276) to Seminole 115 kV (527275) to Seminole 13.2 kV (527273) XFMR CKT 1, near Seminole 230 kV. a. Apply fault at the Seminole 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
65	FLT68-3PH	3 phase fault on the Amocowasson (526784) to OxyBru Tap (527010) 230 kV line circuit 1, near Amocowasson. a. Apply fault at the Amocowasson 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
66	FLT69-3PH	3 phase fault on the Yoakum (526935) to G13-027-TAP (562480) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
67	FLT70-3PH	3 phase fault on the Yoakum 230 kV (526935) to Yoakum 115 kV (526934) to Yoakum 13.2 kV (526932) XFMR CKT 2, near Yoakum 230 kV. a. Apply fault at the Yoakum 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
68	FLT71-3PH	3 phase fault on the Mustang (527146) to Denver North (527130) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
69	FLT72-3PH	3 phase fault on the Mustang (527146) to Seagraves (527202) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
70	FLT73-3PH	3 phase fault on the Mustang (527146) to Denver South (527136) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
71	FLT74-3PH (2017SP & 2025SP Only)	3 phase fault on the Mustang (527146) to Shell Co (527062) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
72	FLT75-3PH	3 phase fault on the Yoakum (526935) to Amoco-SS (526460) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
73	FLT76-3PH	3 phase fault on the Yoakum (526935) to OxyBru Tap (527010) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
74	FLT77-3PH	3 phase fault on the Yoakum (526935) to GEN-2015-079 Tap (560059) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
75	FLT78-SB	**Single phase fault with stuck breaker at Mustang (527149)** a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Mustang 230 kV (527149) /115 kV (527146)/13.2 kV (527143) transformer d. Mustang (527149) - Amocowasson (526784) 230 kV
76	FLT79-SB	**Single phase fault with stuck breaker** on the Tolk West (525531) to GEN-2013-027 (562480) 230 kV line, near Tolk West. a. Apply fault at the Tolk West 230 kV bus. b. Run 5 cycles, and then open GEN-2013-027 end of the faulted line. c. Run 10 cycles, and then clear the fault and disconnect Tolk West 230 kV bus (525531).
77	FLT80-SB	**Single phase fault with stuck breaker** on the Yoakum (526935) to GEN-2013-027 (562480) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Run 5 cycles, and then open GEN-2013-027 end of the faulted line. c. Run 10 cycles, and then clear the fault and open Yoakum end of the line in (b) and trip Yoakum (526935) to Yoakum 115 (526934)/13.2 kV (526931) transformer circuit #1.
78	FLT81-SB	**Single phase fault with stuck breaker** on the Yoakum (526935) to Amoco-SS (526460) 230 kV line, near Yoakum. a. Apply fault at the Yoakum 230 kV bus. b. Run 5 cycles, and then open Amoco-SS end of the faulted line. c. Run 10 cycles, and then clear the fault and trip Yoakum 230 kV (526935) bus.

Cont. No.	Cont. Name	Description
79	FLT82-PO	**Prior Outage of the Mustang (527149) to Seminole (527276) 230 kV line circuit 1;** 3 phase fault on the Mustang (527149) to Yoakum (526935) 230 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
80	FLT83-PO	**Prior Outage of the Mustang (527149) to Yoakum (526935) 230 kV line circuit 1;** 3 phase fault on the Mustang (527149) to Seminole (527276) 230 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
81	FLT84-3PH	3 phase fault on the Woodward (515375) to Border (515458) 345 kV line circuit 1, near Border. a. Apply fault at the Woodward 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
82	FLT85-3PH	3 phase fault on the Tuco (525830) to Carlisle (526161) 230 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
83	FLT86-3PH	3 phase fault on the Tuco (525830) to Tolk East (525524) 230 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
84	FLT87-3PH	3 phase fault on the Tuco (525830) to Jones (526337) 230 kV line circuit 1, near Tuco. a. Apply fault at the Tuco 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
85	FLT88-3PH	3 phase fault on the Tuco 230 kV (525830) to Tuco 115 kV (525828) to Tuco 13.2 kV (525819) XFMR CKT 2, near Tuco 230 kV. a. Apply fault at the Tuco 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
86	FLT89-PO	**Prior Outage of the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525824) XFMR CKT 1;** 3 phase fault on the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525825) XFMR CKT 2, near Tuco 345 kV. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
87	FLT90-PO	**Prior Outage of the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525825) XFMR CKT 2;** 3 phase fault on the Tuco 345 kV (525832) to Tuco 230 kV (525830) to Tuco 13.2 kV (525824) XFMR CKT 1, near Tuco 345 kV. a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
88	FLT91-SB	**Single phase fault with stuck breaker** at **Tuco (525832)** a. Apply fault at the Tuco 345 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Tuco 345 kV (525832) /230 kV (525830) /13.2 kV (525824) transformer d. Tuco (525832) -- OKU (511456) 345 kV
89	FLT92-3PH	3 phase fault on the Crossroads (527656) to Tolk (525549) 345 kV line circuit 1, near Crossroads. a. Apply fault at the Crossroads 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
90	FLT93-3PH	3 phase fault on the Crossroads (527656) to Eddy County (527802) 345 kV line circuit 1, near Crossroads. a. Apply fault at the Crossroads 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
91	FLT94-3PH	3 phase fault on the Tolk 345 kV (525549) to Tolk Tap 230 kV (525543) to Tolk 13.2 kV (525537) XFMR CKT 1, near Tolk 345 kV. a. Apply fault at the Tolk 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer
92	FLT95-3PH	3 phase fault on the Eddy County 345 kV (527802) to Eddy North 230 kV (527799) to Eddy 13.2 kV (527796) XFMR CKT 1, near Eddy County 345 kV. a. Apply fault at the Eddy County 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer
93	FLT96-3PH	3 phase fault on the Atoka (527786) to CV-Dayton (527821) 115 kV line circuit 1, near Atoka. a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
94	FLT97-3PH	3 phase fault on the Atoka (527786) to CV-Irishhill (528116) 115 kV line circuit 1, near Atoka. a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
95	FLT98-3PH	3 phase fault on the Atoka (527786) to Eagle Creek (527711) 115 kV line circuit 1, near Atoka. a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
96	FLT99-3PH	3 phase fault on the CV-Dayton (527821) to Eddy South (527793) 115 kV line circuit 1, near CV-Dayton. a. Apply fault at the CV-Dayton 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
97	FLT100-3PH	3 phase fault on the CV-Irishhill (528116) to CV-Lakewood (528109) 115 kV line circuit 1, near CV-Irishhill. a. Apply fault at the CV-Irishhill 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
98	FLT101-3PH	3 phase fault on the Eagle Creek (527711) to Seven Rivers (528094) 115 kV line circuit 1, near Eagle Creek. a. Apply fault at the Eagle Creek 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
99	FLT102-3PH	3 phase fault on the Eagle Creek (527711) to Eddy North (527798) 115 kV line circuit 1, near Eagle Creek. a. Apply fault at the Eagle Creek 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
100	FLT103-PO	**Prior Outage of the Atoka (527786) to CV-Dayton (527821) 115 kV line circuit 1;** 3 phase fault on the Atoka (527786) to Eagle Creek (527711) 115 kV line circuit 1, near Atoka. a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
101	FLT104-PO	**Prior Outage of the Atoka (527786) to Eagle Creek (527711) 115 kV line circuit 1;** 3 phase fault on the Atoka (527786) to CV-Dayton (527821) 115 kV line circuit 1, near Atoka. a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
102	FLT105-3PH	3 phase fault on the Carlisle (526160) to LP-Doud Tap (526162) 115 kV line circuit 1, near Carlisle. a. Apply fault at the Carlisle 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
103	FLT106-3PH	3 phase fault on the Carlisle 115 kV (526160) to Carlisle 230 kV (526161) to Carlisle 13.2 kV (526157) XFMR CKT 1, near Carlisle 115 kV bus. a. Apply fault at the Carlisle 115 kV bus. b. Clear fault after 5 cycles by tripping the transformer

Cont. No.	Cont. Name	Description
104	FLT107-3PH	3 phase fault on the Carlisle (526160) to SP-Erskine (526109) 115 kV line circuit 1, near Carlisle. a. Apply fault at the Carlisle 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
105	FLT108-3PH	3 phase fault on the Carlisle (526160) to Murphy (526192) 115 kV line circuit 1, near Carlisle. a. Apply fault at the Carlisle 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
106	FLT109-3PH	3 phase fault on the LG-Clauene (526491) to Terry County (526736) 115 kV line circuit 1, near LG-Clauene. a. Apply fault at the LG-Clauene 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
107		DELETED
108	FLT111-3PH	3 phase fault on the Terry County (526736) to Prentice (526792) 115 kV line circuit 1, near Terry County. a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
109	FLT112-3PH	3 phase fault on the Terry County (526736) to Denver North (527130) 115 kV line circuit 1, near Terry County. a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
110	FLT113-3PH	3 phase fault on the Terry County (526736) to Sulphur (527262) 115 kV line circuit 1, near Terry County. a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
111	FLT114-3PH	3 phase fault on the Terry County 115 kV (526736) to Terry County 69 kV (526735) to Terry County 13.2 kV (526733) XFMR CKT 1, near Terry County 115 kV. a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
112	FLT115-3PH	3 phase fault on the Terry County (526736) to Wolf Forth (526524) 115 kV line circuit 1, near Terry County. a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
113	FLT116-3PH	3 phase fault on the LG-Clauene (526491) to LG-Leveland (526484) 115 kV line circuit 1, near LG-Clauene. a. Apply fault at the LG-Clauene 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
114	FLT117-3PH	3 phase fault on the Seagraves (527202) to Sulphur (527262) 115 kV line circuit 1, near Seagraves. a. Apply fault at the Seagraves 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
115	FLT118-3PH	3 phase fault on the Seagraves (527202) to LG-Plshill (527194) 115 kV line circuit 1, near Seagraves. a. Apply fault at the Seagraves 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
116	FLT119-3PH	3 phase fault on the Denver South (527136) to San Andreas (527105) 115 kV line circuit 1, near Denver South. a. Apply fault at the Denver South 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
117	FLT120-3PH	3 phase fault on the Denver South (527136) to Shell C2 (527036) 115 kV line circuit 1, near Denver South. a. Apply fault at the Denver South 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
118	FLT121-3PH	3 phase fault on the Denver South 115 kV (527136) to Denver City 69 kV (527125) to Denver South 13.2 kV (527123) XFMR CKT 2, near Denver South 115 kV. a. Apply fault at the Denver South 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
119	FLT122-PO	**Prior Outage of the Mustang 115 kV (527146) to Mustang 230 kV (527149) to Mustang 13.2 kV (527143) XFMR CKT 1;** 3 phase fault on the Mustang (527146) to Denver South (527136) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
120	FLT123-PO	**Prior Outage of the Mustang 115 kV (527146) to Mustang 230 kV (527149) to Mustang 13.2 kV (527143) XFMR CKT 1;** 3 phase fault on the Mustang (527146) to Denver North (527130) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
121	FLT124-PO	**Prior Outage of the Mustang (527146) to Denver South (527136) 115 kV line circuit 1;** 3 phase fault on the Mustang (527146) to Denver North (527130) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
122	FLT125-PO	**Prior Outage of the Mustang (527146) to Denver North (527130) 115 kV line circuit 1;** 3 phase fault on the Mustang (527146) to Denver South (527136) 115 kV line circuit 1, near Mustang. a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
123	FLT126-3PH	3 phase fault on the GEN-2015-079 Tap (560059) to Hobbs (527894) 230 kV line circuit 1, near GEN-2015-079 Tap. a. Apply fault at the GEN-2015-079 Tap 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
124	FLT127-3PH	3 phase fault on the Hobbs (527894) to Andrews (528604) 230 kV line circuit 1, near Hobbs. a. Apply fault at the Hobbs 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
125	FLT128-3PH	3 phase fault on the Hobbs (527894) to Cunningham (527865) 230 kV line circuit 1, near Hobbs. a. Apply fault at the Hobbs 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
126	FLT129-3PH	3 phase fault on the Hobbs 230 kV (527894) to Hobbs 115 kV (527891) to Hobbs 13.2 kV (527889) XFMR CKT 2, near Hobbs 230 kV. a. Apply fault at the Hobbs 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
127	FLT130-PO (2025SP)	**Prior Outage of the GEN-2015-079 Tap (560059) to Hobbs (527894) 230 kV line circuit 1;** 3 phase fault on the Yoakum (526936) to Tuco (525832) 345 kV line circuit 1, near Yoakum. a. Apply fault at the Yoakum 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
128	FLT131-SB	**Single phase fault with stuck breaker at Chaves County (527482)** a. Apply fault at the Chaves 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Chaves County 230 kV (527483)/ 115 kV (527482)/13.2 kV (527478) transformer d. Chaves County (527482) - Urton (527501) 115 kV

Cont. No.	Cont. Name	Description
129	FLT133-SB	**Single phase fault with stuck breaker at Oasis (524874)** a. Apply fault at the Oasis 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Oasis (524874) - FE-CHZPLT (524863) 115 kV d. Oasis (524874) - Portales (524924) 115 kV
130	FLT134-SB	**Single phase fault with stuck breaker at Amarillo South (524415)** a. Apply fault at the Amarillo South 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Amarillo South (524415) - Nichols (524044) 230 kV d. Amarillo South (524415) - Randall (524365) 230 kV
131	FLT135-SB (20WP, 20SP, 25SP)	**Single phase fault with stuck breaker at Tuco Int (525832)** a. Apply fault at the Tuco Int 345 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Tuco Int (525832) - Border (515458) 345 kV d. Tuco Int (525832) - Yoakum (526936) 345 kV
132	FLT136-SB	**Single phase fault with stuck breaker at Deafsmith (524623)** a. Apply fault at the Deafsmith 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Deafsmith 230 kV (524623)/115 kV (524622)/13.8 kV (524620) transformer d. Deafsmith (524623) - Bushland (524267) 230 kV
133	FLT137-SB	**Single phase fault with stuck breaker at Mustang (527149)** a. Apply fault at the Mustang 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Mustang (527149) - Seminole (527276) 230 kV d. Mustang (527149) - Yoakum (526935) 230 kV
134	FLT138a-SB	**Single phase fault with stuck breaker at EDDY_CNTY (527802)** a. Apply fault at the Eddy County 345 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Eddy County 345 kV (52782)/230 kV (527799)/13.2 kV (527796) transformer d. Eddy County (527802) - Crossroads (527656) 345 kV
135	FLT138b-SB	**Single phase fault with stuck breaker at Tolk (525549)** a. Apply fault at the Tolk 345 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Tolk 345 kV (525549)/230 kV (525543)/13.2 kV (525537) transformer d. Tolk (525549) - Crossroads (527656) 345 kV
136	FLT139-SB	**Single phase fault with stuck breaker at Atoka (527786)** a. Apply fault at the Atoka 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Atoka (527786) - Eagle Creek (527711) 115 kV d. Atoka (527786) - Irish Hill (528116) 115 kV
137	FLT140-SB	**Single phase fault with stuck breaker at Carlisle (526160)** a. Apply fault at the Carlisle 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Carlisle (526160) - Murphy (526192) 115 kV d. Carlisle (526160) - Erskine (526109) 115 kV

Cont. No.	Cont. Name	Description
138	FLT141-SB	**Single phase fault with stuck breaker at Terry County (526736)** a. Apply fault at the Terry County 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Terry County (526736) - Wolfforth (526524) 115 kV d. Terry County (526736) - Denver (527130) 115 kV
139	FLT142-SB	**Single phase fault with stuck breaker at Mustang (527146)** a. Apply fault at the Mustang 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Mustang (527146) - Seagraves (527202) 115 kV d. Mustang (527146) - Denver S (527136) 115 kV
140	FLT143-SB	**Single phase fault with stuck breaker at Hobbs (527894)** a. Apply fault at the Hobbs 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. Hobbs (527894) - Andrews (528604) 230 kV d. Hobbs (527894) - Cunningham (527865) 230 kV

SECTION 3: STABILITY ANALYSIS

The objective of the Stability Analysis was to determine the impacts of the generator interconnections on the stability and voltage recovery on the SPP transmission system. The need for reactive compensation was investigated as stability and voltage recovery violations were identified.

3.1 Approach

SPP provided MEPPI with the following five power flow cases:

- MDWG15-16WP_DIS15024_G06
- MDWG15-17SP_DIS15024_G06
- MDWG15-20SP_DIS15024_G06
- MDWG15-20WP_DIS15024_G06
- MDWG15-25SP_DIS15024_G06

Each case was examined prior to the Stability Analysis to ensure the case contained the proposed study projects and any previously queued projects listed in Tables 2-1 and 2-2 respectively. There was no suspect power flow data in the study area. The dynamic datasets were also verified and stable initial system conditions (i.e., “flat lines”) were achieved. Three-phase and single phase-to-ground faults listed in Table 2-3 were examined. Single-phase fault impedances were calculated for each season to result in a voltage of approximately 60% of the pre-fault voltage. Refer to Table 3-1 for a list of the calculated single-phase fault impedances utilized.

Table 3-1
Calculated Single-Phase Fault Impedances

Cont. No.*	Cont. Name	Single-Phase Fault Impedance (MVA)				
		2016 Winter	2017 Summer	2020 Summer	2020 Winter	2025 Summer
8	FLT10-SB	-812.5	-812.5	-812.5	-812.5	-812.5
40	FLT42-SB	-2609.4	-2609.4	-2609.4	-2812.5	2609.4
58	FLT61-SB	-6875.0	-6168.8	-6875.0	-6875.0	-6875.0
59	FLT62-SB	-6875.0	-6468.8	-6875.0	-6875.0	-6875.0
75	FLT78-SB	-3625.0	-3625.0	-4234.4	-4234.4	-4234.4
76	FLT79-SB	-6875.0	-6468.8	-6875.0	-6875.0	-6875.0
77	FLT80-SB	-3625.0	-3625.0	-4437.5	-4437.5	-4437.5
78	FLT81-SB	-3625.0	-3625.0	-4437.5	-4437.5	-4437.5
88	FLT91-SB	-4437.5	-4843.8	-6062.5	-5250.0	-6062.5
128	FLT131-SB	-812.5	-812.5	-812.5	-812.5	-812.5
129	FLT133-SB	-1312.5	-1250.0	-1312.5	-1312.5	-1312.5
130	FLT134-SB	-3421.9	-3625.0	-3625.0	-3625.0	-3625.0
131	FLT135-SB	-4437.5	-4843.8	-6062.5	-5250.0	6062.5
132	FLT136-SB	-1875.0	-1750.0	-1875.0	-1875.0	-1875.0
133	FLT137-SB	-3625.0	-3625.0	-4234.4	-4234.4	-4234.4
134	FLT138a-SB	-1500.0	-1500.0	-1700.0	-1700.0	-1700.0
135	FLT138b-SB	-1450.0	-1450.0	-1500.0	-1500.0	-1450.0
136	FLT139-SB	-812.5	-875.0	-937.5	-937.5	-937.5
137	FLT140-SB	-1625.0	-1750.0	-1750.0	-1750.0	-1750.0
138	FLT141-SB	-1375.0	-1375.0	-1375.0	-1375.0	-1375.0
139	FLT142-SB	-2812.5	-2812.5	-3015.6	-3015.6	-2812.5
140	FLT143-SB	-3015.6	-3828.1	-4843.8	-4843.8	-5250.0

*Refer to Table 2-3 for a description of the contingency

Bus voltages, machine rotor angles, and previously queued generation in the study area were monitored in addition to bus voltages and machine rotor angles in the following areas:

- 520 AEPW
- 524 OKGE
- 525 WFEC
- 526 SPS
- 531 MIDW
- 534 SUNC
- 536 WERE

Requested and previously queued generation outside the above study area was also monitored.

The results of the analysis determined that reactive compensation and/or system upgrades were required to obtain acceptable system performance. The proposed reactive reinforcements ensure the wind or solar farm meets FERC Order 661A low voltage requirements and return the wind or solar farm to its pre-disturbance operating voltage.

3.2 Stability Analysis Results

The Stability Analysis determined that there were multiple contingencies across all seasons that resulted in system/voltage instability, generation tripping offline, and poor post-fault voltage recovery when all generation interconnection requests were at 100% output.

Refer to Table 3-2 for a summary of the Stability Analysis results for the contingencies listed in Table 2-3. Table 3-2 is a summary of the stability results for the 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions and states whether the system remained stable or generation tripped offline, if acceptable voltage recovery was observed after the fault was cleared, and if the voltage recovered to above 0.9 p.u. and below 1.1 p.u. post fault steady-state conditions. Voltage recovery criteria includes ensuring that the transient voltage recovery is between 0.7 p.u. within 2.5 seconds after the fault is cleared and 1.2 p.u. at any point after the fault is cleared and ending in a steady-state voltage (for N-1 contingencies) at the pre-contingent level or at least above 0.9 p.u. and below 1.1. p.u.

Refer to Appendix B, Appendix C, Appendix D, Appendix E, and Appendix F for a complete set of plots for all contingencies for 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions, respectively.

Table 3-2
Stability Analysis Summary of Results for 2016 Winter, 2017 Summer, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2016 Winter Peak				2017 Summer Peak				2020 Summer Peak				2020 Winter Peak				2025 Summer Peak			
		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault	
		Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability
1	FLT01-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
2	FLT02-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
3	FLT03-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
4	FLT04-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
5	FLT05-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
6	FLT06-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
7	FLT07-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
8	FLT10-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
9	FLT11-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
11	FLT13-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
12	FLT14-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
13	FLT15-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
14	FLT16-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
15	FLT17-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
16	FLT18-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
17	FLT19-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
18	FLT20-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
19	FLT21-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
20	FLT22-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
21	FLT23-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
22	FLT24-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
23	FLT25-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
24	FLT26-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
25	FLT27-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
26	FLT28-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
27	FLT29-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Unstable	-	-	Compliant	Unstable	-	-	Compliant	Unstable	-	-	Compliant	Unstable
28	FLT30-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
29	FLT31-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
30	FLT32-PO	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
31	FLT33-PO	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
32	FLT34-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
33	FLT35-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
34	FLT36-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
35	FLT37-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
36	FLT38-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
37	FLT39-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
38	FLT40-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable

Table 3-2 (continued)
Stability Analysis Summary of Results for 2016 Winter, 2017 Summer, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2016 Winter Peak				2017 Summer Peak				2020 Summer Peak				2020 Winter Peak				2025 Summer Peak			
		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault	
		Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability
39	FLT41-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
40	FLT42-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
41	FLT43-3PH	-	-	Not Compliant	Unstable	-	-	Compliant	Stable	-	-	Compliant	Unstable	-	-	Compliant	Unstable	-	-	Compliant	Stable
43	FLT45-3PH	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	V < 0.9	Unstable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable
44	FLT46-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
45	FLT47-3PH (20WP, 20SP, 25SP)									-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
46	FLT48-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
47	FLT49-3PH	-	-	Not Compliant	Unstable	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	Compliant	Stable
48	FLT50-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable
49	FLT51-PO	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	V < 0.9	Unstable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable
50	FLT52-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
51	FLT54-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
52	FLT55-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
53	FLT56-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
54	FLT57-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
55	FLT58-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
56	FLT59-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
57	FLT60-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
58	FLT61-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
59	FLT62-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
60	FLT63-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
61	FLT64-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
62	FLT65-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
63	FLT66-3PH	-	-	Compliant	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable
64	FLT67-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
65	FLT68-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
66	FLT69-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
67	FLT70-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
68	FLT71-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
69	FLT72-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
70	FLT73-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
71	FLT74-3PH (2017SP & 2025SP Only)					-	-	Compliant	Stable									-	-	Compliant	Stable

Table 3-2 (continued)
Stability Analysis Summary of Results for 2016 Winter, 2017 Summer, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2016 Winter Peak				2017 Summer Peak				2020 Summer Peak				2020 Winter Peak				2025 Summer Peak			
		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault	
		Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability
72	FLT75-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
73	FLT76-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
74	FLT77-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
75	FLT78-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
76	FLT79-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
77	FLT80-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
78	FLT81-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
79	FLT82-PO	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable
80	FLT83-PO	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable
81	FLT84-3PH	-	-	V < 0.9	Unstable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
82	FLT85-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
83	FLT86-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
84	FLT87-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
85	FLT88-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
86	FLT89-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
87	FLT90-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
88	FLT91-SB	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable
89	FLT92-3PH	-	-	Compliant	Gen Trip	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
90	FLT93-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
91	FLT94-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
92	FLT95-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
93	FLT96-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
94	FLT97-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
95	FLT98-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
96	FLT99-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
97	FLT100-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
98	FLT101-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
99	FLT102-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
100	FLT103-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
101	FLT104-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
102	FLT105-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
103	FLT106-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
104	FLT107-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
105	FLT108-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
106	FLT109-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable

Table 3-2 (continued)
Stability Analysis Summary of Results for 2016 Winter, 2017 Summer, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2016 Winter Peak				2017 Summer Peak				2020 Summer Peak				2020 Winter Peak				2025 Summer Peak			
		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault	
		Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability
108	FLT111-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
109	FLT112-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
110	FLT113-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
111	FLT114-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
112	FLT115-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
113	FLT116-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
114	FLT117-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
115	FLT118-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
116	FLT119-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
117	FLT120-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
118	FLT121-3PH	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
119	FLT122-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
120	FLT123-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
121	FLT124-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
122	FLT125-PO	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
123	FLT126-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
124	FLT127-3PH	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable
125	FLT128-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
126	FLT129-3PH	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
127	FLT130-PO (2025SP)																	-	-	Compliant	Stable
128	FLT131-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
130	FLT133-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
131	FLT134-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
132	FLT135-SB(20WP, 20SP, 25SP)									-	-	V < 0.9	Stable	-	-	V < 0.9	Unstable	-	-	Compliant	Stable
133	FLT136-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	V < 0.9	Stable	-	-	Compliant	Stable
134	FLT137-SB	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable	-	-	V < 0.9	Stable
135	FLT138a-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
136	FLT138b-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
137	FLT139-SB	-	-	V < 0.9	Unstable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
138	FLT140-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
139	FLT141-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
140	FLT142-SB	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
141	FLT143-SB	-	-	V < 0.9	Unstable	-	-	V < 0.9	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable

To mitigate the system/voltage instability, voltage violations, generation tripping offline, and poor post-fault steady-state voltages, the following upgrades were provided by SPP and implemented in each season:

- OKU Reactive Power Support
  - 2 x 50 Mvar switched shunts
- Crawfish Draw Substation
  - Tap Tuco – Border 345 kV
  - Tap Tuco – Swisher 230 kV
  - Crawfish Draw 345/230 kV transformer
- Tuco – Crawfish Draw – Border 345 kV circuit #2
  - Reroute Yoakum – Tuco to Yoakum – Crawfish Draw
- Border – Chisholm 345 kV circuit #1 and #2

Note that after the above upgrades were implemented for the following faults, the post-fault steady-state voltage violations are not a concern because the bus in violation is at the end of a radial line segment and not serving load:

- FLT66-3PH: 3PH fault resulting in the loss of Mustang to Seminole 230 kV (17SP, 20SP, 20WP, 25SP)
- FLT82-PO: Prior outage of Mustang to Seminole 230 kV followed by a 3PH fault resulting in the loss of Mustang to Yoakum 230 kV (All seasons)
- FLT83-PO: Prior outage of Mustang to Yoakum 230 kV line followed by a 3PH fault resulting in the loss of Mustang to Seminole 230 kV (All seasons)
- FLT127-3PH: 3PH fault resulting in the loss of Hobbs to Andrews 230 kV (16WP, 17SP, 20WP, 25SP)
- FLT137-SB: 1PH stuck breaker fault resulting in the loss of Mustang to Seminole 230 kV and Mustang Yoakum 230 kV (All seasons)
- FLT143-SB: 1PH stuck breaker fault resulting in the loss of Hobbs to Andrews 230 kV and Hobbs to Cunningham 230 kV (16WP, 17SP)

Refer to Figure 3-1 and Figure 3-2 for a one-line diagram of the post-fault topology near Seminole 230 kV and Andrews 230 kV, respectively. It can be observed that both buses are at the end of a radial segment and do not serve load, therefore, are not a cause for concern.

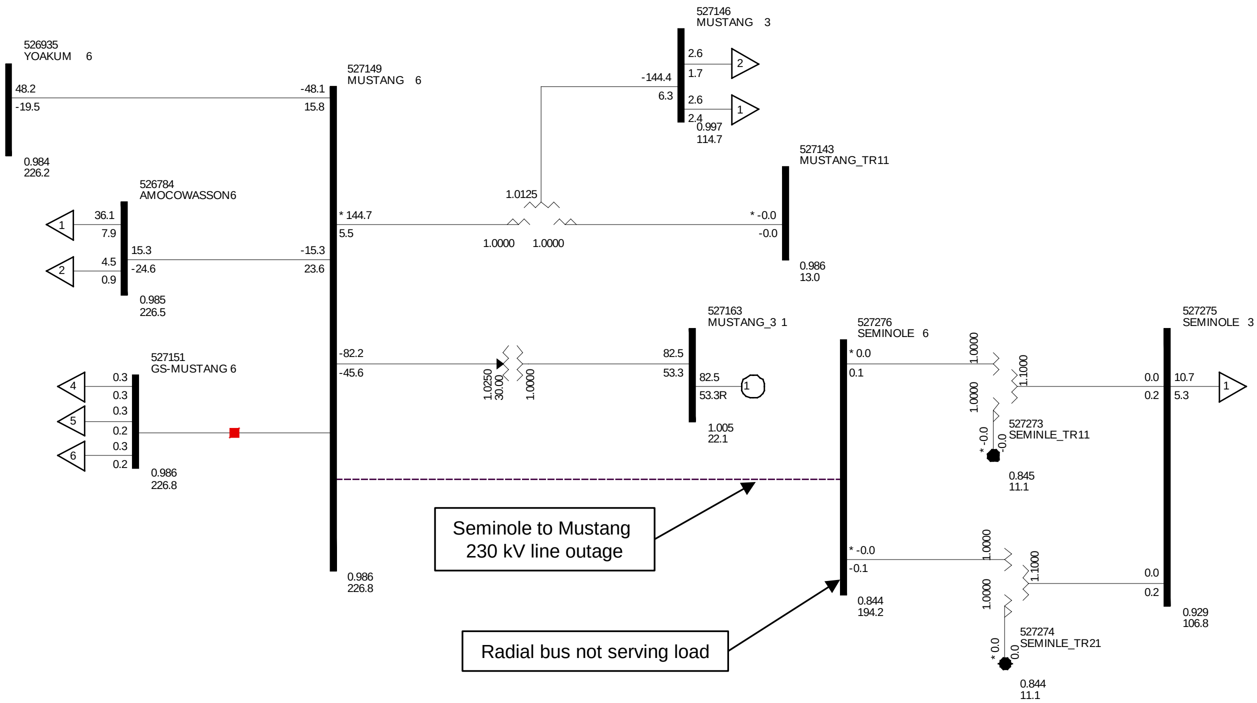


Figure 3-1: One-line diagram of post-fault steady-state topology for FLT66-3PH.

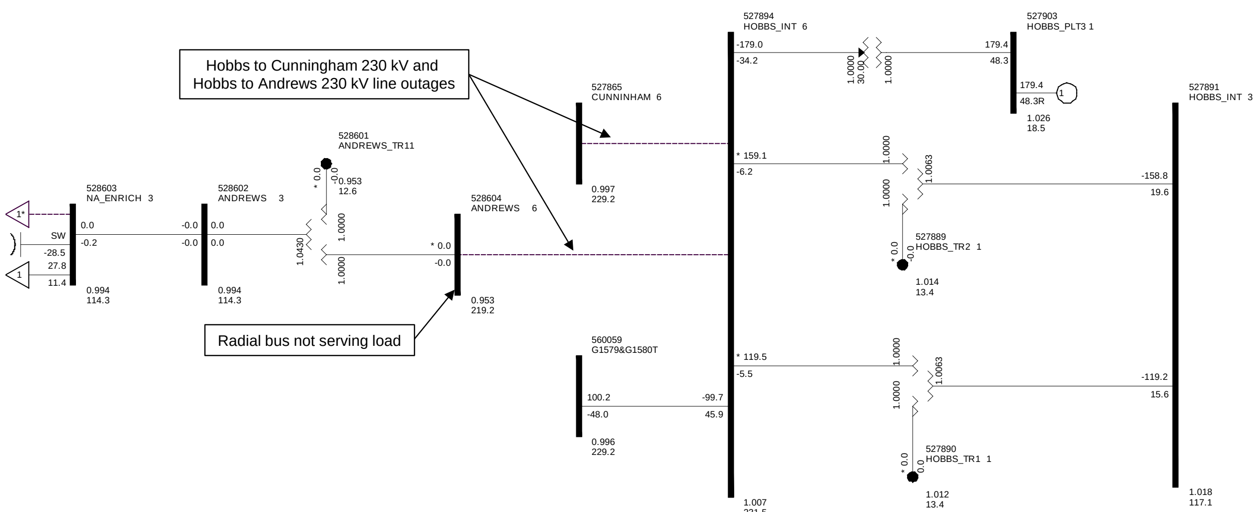


Figure 3-2: One-line diagram of post-fault steady-state topology for FLT143-SB.

Voltage below 0.9 p.u. was consistently observed for the Oklaunion 345 kV bus (511456) for several cases for all examined seasonal peak conditions. After implementing the upgrades provided by SPP, the observed voltage violation was mitigated. Refer to Figure 3-3 for a representative plot of the bus voltage at Oklaunion 345 kV for FLT28-3PH, a 3PH fault resulting in the loss of the Oasis 230kV/115kV/13.2kV transformer for the 2016 Winter Peak case with and without system upgrades.

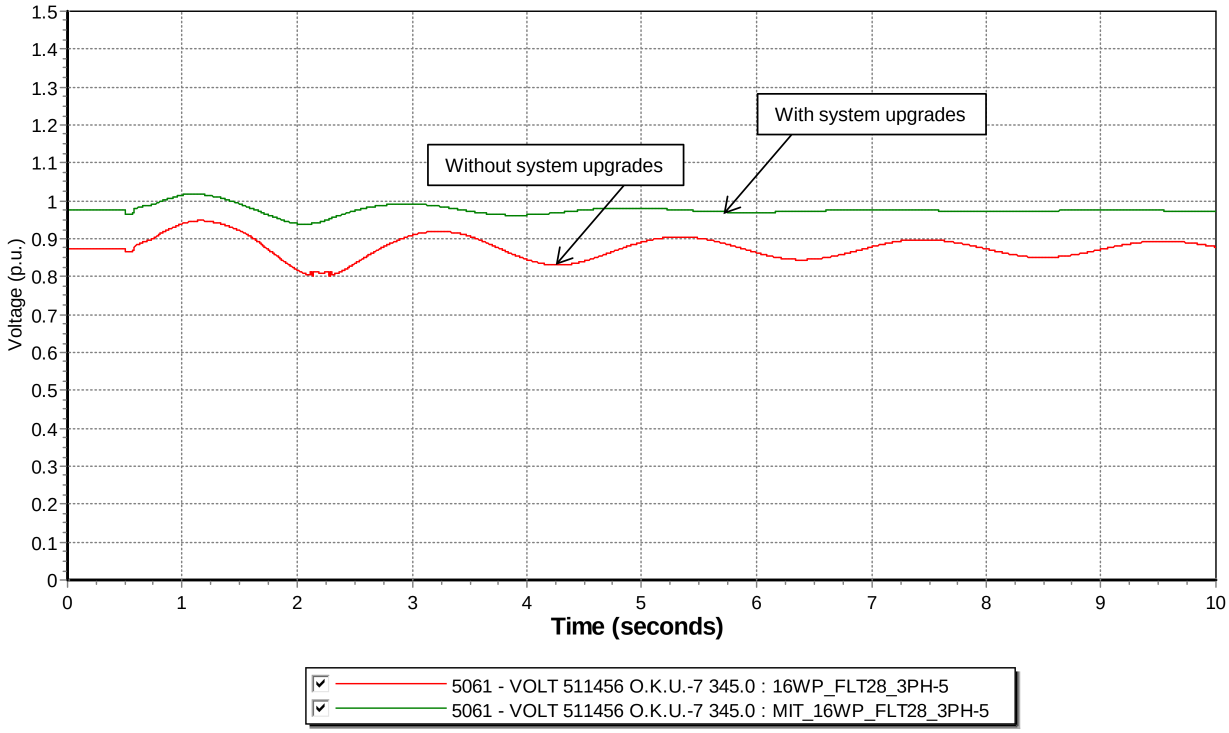


Figure 3-3: Representative plot of Oklaunion area voltages for 2016 Winter Peak conditions with and without system upgrades.

It was observed that FLT29-3PH, which is a 3PH fault resulting in the loss of Oasis to San Juan Tap 230 kV line, resulted in voltage instability at San Juan for all seasonal peak conditions. In addition to the upgrades provided by SPP, it was determined that the switched shunt at the SNHN-CB1 34.5 kV bus also has to be set to 26.64 Mvar. After implementing these upgrades and adjustment, the observed voltage instability was mitigated. Refer to Figure 3-4 for a representative plot of the bus voltage at San Juan Tap for the 2016 Winter Peak case with and without system upgrades.

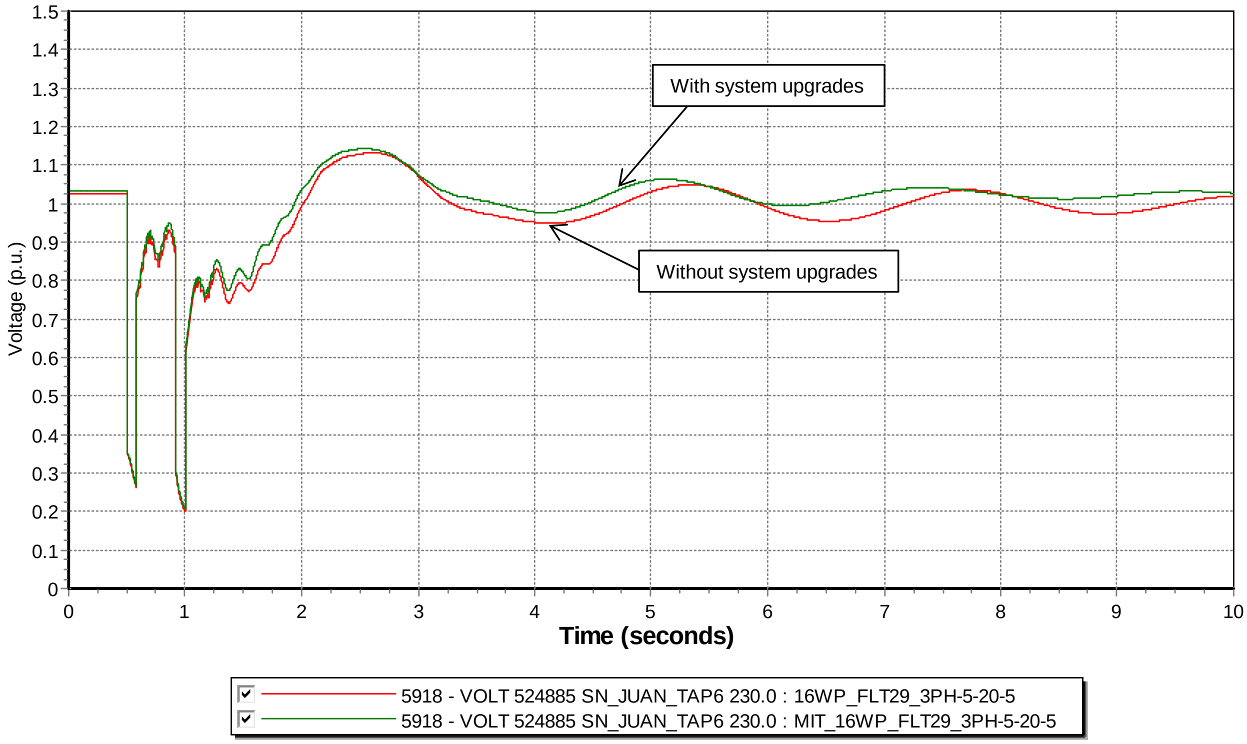


Figure 3-4: Representative plot of San Juan area voltages for 2016 Winter Peak conditions with and without system upgrades.

It was observed that FLT49-3PH, which is a 3PH fault resulting in the loss of the Oklaunion to L.E.S. 345 kV line, resulted in voltage instability for 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak and 2020 Winter Peak conditions. After implementing the upgrades, the observed voltage instability was mitigated. Refer to Figure 3-5 for a representative plot of the bus voltage at Oklaunion for the 2017 Summer Peak case with and without system upgrades.

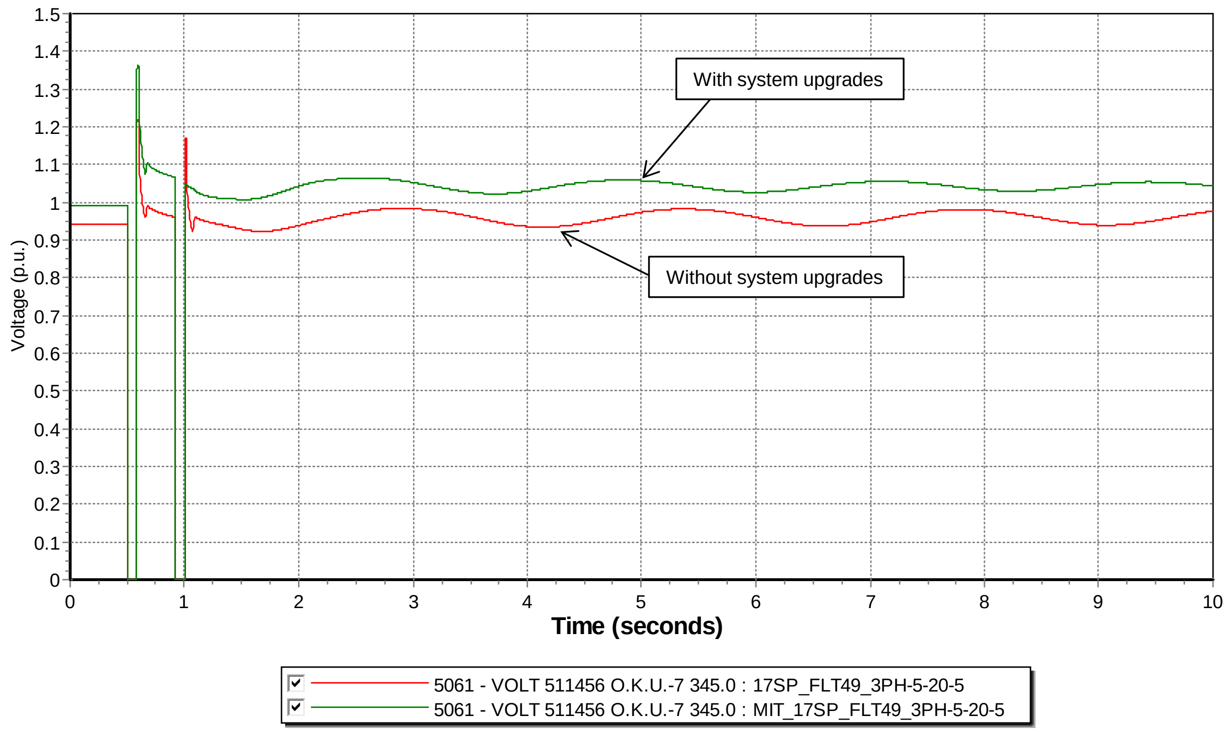


Figure 3-5: Representative plot of Oklaunion area voltage for 2017 Summer Peak conditions with and without system upgrades.

It was observed that for FLT92-3PH, which is a 3PH fault resulting in the loss of Crossroad to Tolk 345 kV line, resulted in the tripping of GEN-2008-022 for 2016 Winter Peak conditions. After the implementation of the upgrades provided by SPP, the observed violation was mitigated. Refer to Figure 3-6 for a representative plot of the status of GEN-2008-022 for FLT92-3PH for the 2016 Winter Peak case with and without system upgrades.

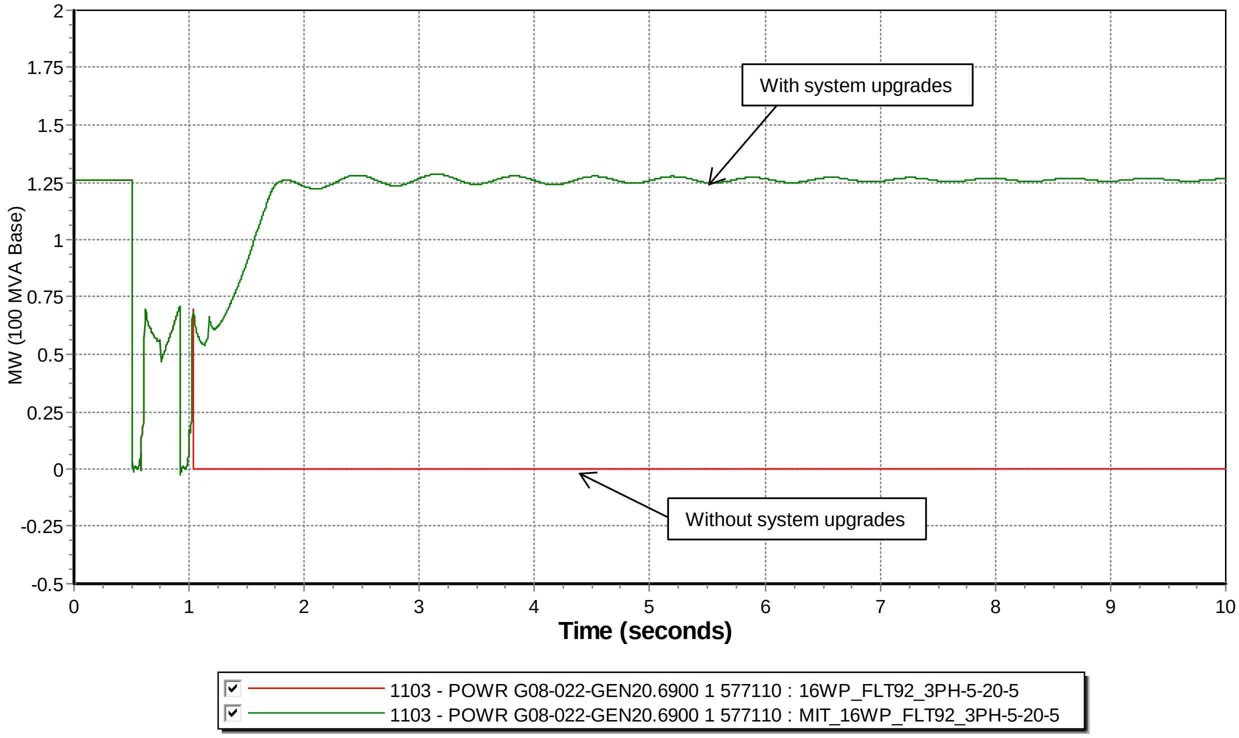


Figure 3-6: Representative plot of the status of GEN-2008-022 for 2016 Winter Peak conditions with and without system upgrades.

After the upgrades were implemented, the Stability Analysis was re-simulated to determine system stability. With the required upgrade, the Stability Analysis determined that there was no wind turbine tripping or system instability as a result of interconnected all study projects at 100% output.

SECTION 4: SHORT CIRCUIT ANALYSIS

The objective of this task is to quantify the three-phase to ground fault currents for the 2017 Summer Peak and 2025 Summer Peak seasons for each interconnecting generator.

4.1 Approach

The short-circuit analysis will assess breaker adequacy and fault duties for the generator interconnection bus and five buses away from the point of interconnection. MEPPI will assume no outages to find maximum short-circuit currents that flow through the breaker. The Automatic Sequencing Fault Calculation (ASCC) function in PSS/E was utilized to perform this task. FLAT conditions were applied to pre-fault conditions and the following adjustments were utilized:

- All synchronous and asynchronous machine P and Q output was set to zero
- All transformer tap ratios were set to 1.0 p.u. and all phase shift angles were set to zero
- All generator reactance's were fixed to the subtransient reactance
- All line charging was set to zero
- All shunts were set to zero
- All loads were set to zero
- All pre-fault bus voltages were set to 1.0 p.u. and a phase shift angle of zero

Note upgrades found to be necessary for the Stability Analysis were included in the Short-Circuit Analysis.

4.2 Short Circuit Results: 2017 Summer Peak

The maximum fault current for each bus is provided for the 2017 Summer Peak conditions. The following tables show the short circuit results for the study generators for the 2017 Summer Peak condition:

- Table 4-1: Short Circuit Analysis for GEN-2015-020 (17SP)
- Table 4-2: Short Circuit Analysis for GEN-2015-031 (17SP)
- Table 4-3: Short Circuit Analysis for GEN-2015-056 (17SP)
- Table 4-4: Short Circuit Analysis for GEN-2015-058 (17SP)
- Table 4-5: Short Circuit Analysis for GEN-2015-068 (17SP)
- Table 4-6: Short Circuit Analysis for GEN-2015-075 (17SP)
- Table 4-7: Short Circuit Analysis for GEN-2015-079 and GEN-2015-080 (17SP)

Table 4-1
Short Circuit Analysis for Study Project GEN-2015-020 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524486	CAPROCK 3	115	2851.7
524502	NORTON 3	115	2715.1
524509	FE-TUCMCARI3	115	1929.2
524662	PARMER_CO 3	115	4068.1
524669	DS-#20 3	115	4766.8
524764	NORRIS_TP 3	115	10214.5
524768	PLSNT_HILL 3	115	9585.3
524770	PLSNT_HILL 6	230	5976.4
524773	E_CLOVIS 3	115	8250.3
524776	N_CLOVIS_TP3	115	7019.6
524777	N_CLOVIS 3	115	6369.8
524783	W_CLOVIS 2	69	2403.9
524784	W_CLOVIS 3	115	6013.2
524790	CANNON_TP 3	115	5731.5
524794	CANNONAFB 3	115	5391.5
524797	PERIMETER 3	115	6241.5
524801	NORRIS 3	115	9405.2
524808	FE-CLVS_INT3	115	6562.3
524821	CURRY 2	69	4313.5
524822	CURRY 3	115	10240
524831	FE-HOLLAND 3	115	8491.9
524838	FE-CLOVIS2 3	115	9724.9
524846	FARWELL 2	69	2072.5
524863	FE-CHZPLT 3	115	7529
524874	OASIS 3	115	9370.2
524875	OASIS 6	230	7168.1
524885	SN_JUAN_TAP6	230	4613.8
524889	SN_JUAN_WND6	230	4429
524908	ROOSEVELT 3	115	10063.5
524909	ROSEVELT_N 6	230	8593.4
524911	ROSEVELT_S 6	230	8593.4
524915	SW_4K33 6	230	8593.4
524923	PORTALES 2	69	7053.4
524924	PORTALES 3	115	7119.9
524929	RO-PORT_MTR2	69	7053.4
524934	ZODIAC 2	69	5267.1
524935	KILGORE 3	115	5573.4
524941	PORTALES#1 2	69	5453.5
524948	PORTALES#2 2	69	4648.8
524962	S_PORTALES 2	69	4145.3
524976	MARKET_ST 2	69	3930.7
525019	EMU&VLY_TP 3	115	5085.9
525027	BAILEYCO 2	69	4790
525028	BAILEYCO 3	115	4866.3
525481	PLANT_X 6	230	21995.3
525524	TOLK_EAST 6	230	25460.3
525531	TOLK_WEST 6	230	25460.3
525543	TOLK_TAP 6	230	25460.3
525637	LAMB_CNTY 6	230	5321.3
525830	TUCO_INT 6	230	19769.1
527481	CHAVES_CNTY2	69	2261.3
527482	CHAVES_CNTY3	115	6148.2
527483	CHAVES_CNTY6	230	3962.3
527501	URTON 3	115	5222.3
527546	SAMSON 3	115	4886.4
527793	EDDY_STH 3	115	10033
527799	EDDY_NORTH 6	230	7132.3
527800	EDDY_SOUTH 6	230	7132.3
527802	EDDY_CNTY 7	345	4061.2
562480	G13-027-TAP	230	8858.4
583280	ASGI2012-002	115	1039.6
583310	GEN-2013-022	115	2665.6
583950	GEN-2014-033	115	6089.3
583960	G14034G14035	115	5832.9
584620	GEN-2015-020	115	9140
599955	PNM-DC6	230	8593.4
599960	EPTNP-D6	230	7132.3

Table 4-2
Short Circuit Analysis for Study Project GEN-2015-031 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5032.3
511468	L.E.S.-7	345	11981.4
515375	WWRDEHV7	345	16032.5
515458	BORDER 7	345	4943.9
522800	MU-TULIA 3	115	5080.3
522823	LP-MILWAKEE6	230	9755.8
522828	LP-MILWAKEE2	69	7473.7
522861	LP-SOUTHEST6	230	13530.3
522866	LP-COOK 2	69	30408.2
522870	LP-HOLLY 6	230	14518.9
522888	LP-WADSWRTH6	230	11881.2
523095	HITCHLAND 6	230	14769.4
523097	HITCHLAND 7	345	15393.3
523221	XIT_INTG 6	230	2597.6
523267	PRINGLE 6	230	4259.9
523308	MOORE_E 3	115	10989.9
523309	MOORE_CNTY 6	230	6688
523332	EXELL_TP 3	115	4806.4
523339	FAIN 3	115	5271.8
523344	BLKHAWK_W 3	115	11803.7
523377	RIVERVIEW 3	115	13268.6
523410	CRMWA_#4 3	115	9699.2
523485	CAMX/AGR TP3	115	13893
523494	MEREDITH 3	115	7720.5
523543	HUTCHISON 2	69	9040.5
523544	HUTCH_N 3	115	15570.9
523546	HUTCH_S 3	115	15570.9
523551	HUTCHISON 6	230	7187.7
523636	GRAY_CNTY 3	115	3894.9
523748	BOWERS 3	115	6778
523770	GRAPEVINE 3	115	7761.8
523771	GRAPEVINE 6	230	5566.3
523776	WHEELER 3	115	6148.2
523777	WHEELER 6	230	5385.6
523779	STLN-DEMARC6	230	6087.5
523815	LLANO_WND 3	115	9422.5
523817	MIDSTRM_TP 3	115	6705.6
523869	CHAN/TASCOS6	230	3841.2
523928	MARTIN 3	115	7464.2
523931	HIGHLAND_TP3	115	11360.7
523959	POTTER_CO 6	230	20175.2
523961	POTTER_CO 7	345	7416.2
523977	HARRNG_WST 6	230	25896
523978	HARRNG_MID 6	230	25896
523979	HARRNG_EST 6	230	25896
524007	ROLLHILLS 3	115	19273
524009	CHERRY 3	115	18435.2
524010	ROLLHILLS 6	230	19211.2
524016	ASARCO 3	115	26359.3
524018	ASARCO_TP 3	115	28489.4
524043	NICHOLS 3	115	30451.2
524044	NICHOLS 6	230	25163.5
524058	WHITAKER 3	115	21829.6
524079	CONWAY 3	115	4990.3
524088	KIRBY 3	115	5381.1
524106	NORTHWEST 3	115	11235.8
524136	HASTINGS 3	115	13683.6
524162	EAST_PLANT 3	115	22812
524163	EAST_PLANT 6	230	13623.6
524185	PIERCE_TP 3	115	18942.7
524224	MANHATTAN 3	115	18341.8
524266	BUSHLAND 3	115	9322
524267	BUSHLAND 6	230	9619.4
524282	34TH_ST 3	115	14893.5
524290	WILDOR2_JUS6	230	6595.7
524296	SPNSPUR_WND7	345	4447.9
524306	COULTER 3	115	15123.6
524321	GEORGIA 2	69	6642.5
524322	GEORGIA 3	115	16308.2
524331	PULLMAN 3	115	7097.7
524338	SOUTHEAST 3	115	10967.7
524345	OSAGE 3	115	13708.1
524364	RANDALL 3	115	20788
524365	RANDALL 6	230	14180.3
524377	FARMERS 3	115	15035.3
524388	CROUSE_HIND3	115	15041.1
524397	ARROWHEAD 3	115	13538.6
524404	OWENSCORN 3	115	14748.9
524414	AMA_SOUTH 3	115	16539.6
524415	AMA_SOUTH 6	230	13372.7
524425	ESTACADO_TP3	115	13160.4
524432	ESTACADO 3	115	11598.8
524516	CANYON_WEST3	115	4904.8
524522	CANYON E_TP3	115	5148.8
524523	CANYON_EAST3	115	4785.7
524530	PALO_DURO 3	115	6535.8
524544	SPRING_DRW 3	115	6353.5
524622	DEAFSMITH 3	115	11935.5
524623	DEAFSMITH 6	230	7691.4
524694	DS-#22 3	115	4955.9
524734	DS-#21 3	115	10779
524745	CASTRO_CNTY2	69	9584.9
524746	CASTRO_CNTY3	115	11616.8
524909	ROSEVELT_N 6	230	8593.4
524911	ROSEVELT_S 6	230	8593.4
524915	SW_4K33 6	230	8593.4
525019	EMU&VLY_TP 3	115	5085.9
525050	BC-KELLEY 3	115	8335.9
525056	BC-EARTH 3	115	8743.4
525124	HART_INDUST3	115	7562.8
525154	HAPPY_INT 3	115	5340.4
525179	TULIA_TP 3	115	6275.1
525191	KRESS_INT 2	69	4426
525192	KRESS_INT 3	115	11103.9
525203	SW-KRESS 2	69	4426
525212	SWISHER 3	115	10258
525213	SWISHER 6	230	10343.3
525224	KRESS_RURL 2	69	2504.5
525225	KRESS_RURAL3	115	6221.8
525257	N_PLAINVEW 3	115	5066.8
525326	COX 3	115	5864.4
525414	LAMTON 3	115	7770.7
525446	SPGLAKE_TP3	115	10518.1
525453	HALE_CNTY 2	69	6899
525454	HALE_CNTY 3	115	10097.3
525460	NEWHART 3	115	15057.7
525461	NEWHART 6	230	10798.4
525480	PLANT_X 3	115	20827.9
525481	PLANT_X 6	230	21995.3
525524	TOLK_EAST 6	230	25460.3
525531	TOLK_WEST 6	230	25460.3
525543	TOLK_TAP 6	230	25460.3
525549	TOLK 7	345	6945
525636	LAMB_CNTY 3	115	8481
525637	LAMB_CNTY 6	230	5321.3
525731	SP-ABERNTHY2	69	3006.7
525738	HALECENTER 2	69	2454.5
525779	FLOYD_CNTY 2	69	5288
525780	FLOYD_CNTY 3	115	5987.7
525816	TUCO_INT2 2	69	4646.9
525826	TUCO_INT 2	69	7838.1
525828	TUCO_INT 3	115	19190.2
525830	TUCO_INT 6	230	19769.1
525832	TUCO_INT 7	345	10625.9
525840	ANTELOPE_1 6	230	19618.7
525853	LH-WIL&ELLN2	69	2573.8
525885	SP-NEWDEAL 2	69	3372.2
525926	CROSBY 3	115	4477.7
526076	STANTON_W 3	115	9282.8
526109	SP-ERSKINE 3	115	11256.4
526146	INDIANA 3	115	9629.3
526159	CARLISLE 2	69	2563.6
526160	CARLISLE 3	115	13043.6
526161	CARLISLE 6	230	10368.1
526162	LP-DOUD_TP 3	115	11521.8
526192	MURPHY 3	115	10545.5
526268	LUBBCK_STH 3	115	18636.3
526269	LUBBCK_STH 6	230	17070.7
526297	LUBBCK_EST 2	69	7999.4
526298	LUBBCK_EST 3	115	15011.8

Table 4-2 (continued)
Short Circuit Analysis for Study Project GEN-2015-031 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
526299	LUBBCK_EST 6	230	12694.2	526676	GRASSLAND 3	115	6093.9	583340	GEN-2012-020	230	8741.8
526337	JONES 6	230	19267.5	526677	GRASSLAND 6	230	6360.2	584220	GEN-2014-040	115	10333.5
526434	SUNDOWN 3	115	11207.8	526679	CIRRUS_WND 6	230	4970.3	584640	GEN-2015-022	115	10258
526435	SUNDOWN 6	230	10471.7	560050	G15-031-TAP	230	8939.7	584750	GEN-2015-031	230	7633.6
526460	AMOCO_SS 6	230	9117.5	562004	G11-025-TAP	115	4584.4	585060	GEN-2015-068	345	8867.9
526524	WOLFFORTH 3	115	11356.5	562480	G13-027-TAP	230	8858.4	599891	OKLAUN 7	345	4042.1
526525	WOLFFORTH 6	230	12794.7	583090	G1149&G1504	345	4532.3	599955	PNM-DC6	230	8593.4

Table 4-3
Short Circuit Analysis for Study Project GEN-2015-056 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524623	DEAFSMITH 6	230	7258.6
524770	PLSNT_HILL 6	230	5318.4
524875	OASIS 6	230	6405.8
524885	SN_JUAN_TAP6	230	4127.3
524889	SN_JUAN_WND6	230	3964.5
524908	ROOSEVELT 3	115	8914.2
524909	ROSEVELT_N 6	230	7728.3
524911	ROSEVELT_S 6	230	7728.3
524915	SW_4K33 6	230	7728.3
525213	SWISHER 6	230	10072
525461	NEWHART 6	230	10219.6
525480	PLANT_X 3	115	19102.2
525481	PLANT_X 6	230	20386.9
525524	TOLK_EAST 6	230	23749.8
525531	TOLK_WEST 6	230	23749.8
525543	TOLK_TAP 6	230	23749.8
525549	TOLK 7	345	6325.7
525636	LAMB_CNTY 3	115	7911
525637	LAMB_CNTY 6	230	4957
525828	TUCO_INT 3	115	19170.1
525830	TUCO_INT 6	230	20302.5
525832	TUCO_INT 7	345	11600.4
525840	ANTELOPE_1 6	230	20148

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
526161	CARLISLE 6	230	10187.9
526337	JONES 6	230	18151.4
526435	SUNDOWN 6	230	9966.8
526935	YOAKUM 6	230	11204
527481	CHAVES_CNTY2	69	2019.4
527482	CHAVES_CNTY3	115	5490.7
527483	CHAVES_CNTY6	230	3555.1
527501	URTON 3	115	4663.1
527546	SAMSON 3	115	4362.6
527597	TWEEDY 3	115	4162.1
527656	CROSSROADS 7	345	4873.1
527711	EAGLE_CREEK3	115	6151.9
527786	ATOKA 3	115	5937.4
527793	EDDY_STH 3	115	9106.7
527798	EDDY_NTH 3	115	9106.7
527799	EDDY_NORTH 6	230	6489.7
527800	EDDY_SOUTH 6	230	6489.7
527802	EDDY_CNTY 7	345	3673.9
527809	CV-8_MILE 3	115	4567
527821	CV-DAYTON 3	115	5865.7
527864	CUNNINHAM 3	115	24331.1
527865	CUNNINHAM 6	230	13635.4
527894	HOBBS_INT 6	230	13954.2

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
527963	POTASH_JCT 6	230	5658.4
528070	CV-AZMESA 3	115	5962.5
528094	7-RIVERS 3	115	6715
528095	7-RIVERS 6	230	4928.1
528132	OCOTILLO 3	115	4780.8
528137	N_CANAL 3	115	6350.9
528160	CARLSBAD 3	115	7724.3
528178	PECOS 3	115	8110.4
528179	PECOS 6	230	5097.9
528226	HOPI_SUB 3	115	3337.8
562480	G13-027-TAP	230	8241.1
577103	GEN-2008-022	345	4616.3
577104	G08-022-WEST	345	4336
583340	GEN-2012-020	230	8753.3
583840	GEN-2013-027	230	7823.8
583950	GEN-2014-033	115	5438.1
583960	G14034G14035	115	5208.9
584260	GEN-2014-047	345	3939.9
584940	GEN-2015-056	345	4309.8
599955	PNM-DC6	230	7728.3
599960	EPTNP-D6	230	6489.7

Table 4-4
Short Circuit Analysis for Study Project GEN-2015-058 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524885	SN_JUAN_TAP6	230	4127.3
527482	CHAVES_CNTY3	115	5490.7
527483	CHAVES_CNTY6	230	3555.1
527534	BRASHER_TP 3	115	4424.4
527541	CAPITAN 3	115	2987
527546	SAMSON 3	115	4362.6
527563	ROSWLL_INT 2	69	3080.6
527564	ROSWLL_INT 3	115	4441.4
527597	TWEEDY 3	115	4162.1
527656	CROSSROADS 7	345	4873.1
527664	CV-CTTNWOOD2	69	2399.1
527678	SMITH 2	69	3415
527701	ARTESIA 2	69	3418.1
527707	ARTESIA 3	115	5694.5
527710	EAGLE_CREEK2	69	2073.9
527711	EAGLE_CREEK3	115	6151.9
527715	NAVAJO_2TP 3	115	5885.9
527717	NAVAJO_2 3	115	5821.8
527720	NAVAJO_3 3	115	5854.5
527733	NAVAJO_1 2	69	1945.5
527736	NAVAJO_5TP 3	115	5854.5
527739	NAVAJO_4 3	115	5842
527743	NAVAJO_5 3	115	5843.7
527747	ARTESIA_TWN2	69	1915.9
527754	CV-ARTESIA 2	69	2781.8
527757	ARTESIA_TP 2	69	3291.7
527761	ARTESIA_W 2	69	3002.2
527762	ARTSA_CC_TP2	69	1728.3
527763	CV-W_ARTSIA2	69	1457.2
527768	ARTESIA_CC 2	69	1576.2
527772	ARTSA_SR_TP2	69	1789.2
527775	ARTESIA_SR 2	69	1723.3
527785	ATOKA 2	69	2115
527786	ATOKA 3	115	5937.4
527793	EDDY_STH 3	115	9106.7
527798	EDDY_NTH 3	115	9106.7
527799	EDDY_NORTH 6	230	6489.7
527800	EDDY_SOUTH 6	230	6489.7
527802	EDDY_CNTY 7	345	3673.9
527808	CV-8_MILE 2	67	1630.1
527809	CV-8_MILE 3	115	4567
527810	CV-ABO 2	67	1444.8
527811	CV-KEWAN_TP3	115	2553.3
527821	CV-DAYTON 3	115	5865.7
527822	CV-TURKYTRK3	115	2987
527864	CUNNINHAM 3	115	24331.1
527865	CUNNINHAM 6	230	13635.4
527894	HOBBS_INT 6	230	13954.2
527930	PCA 3	115	7388.5
527962	POTASH_JCT 3	115	7842.7
527963	POTASH_JCT 6	230	5658.4
528003	CV-DAGGR&IH2	69	1465
528070	CV-AZMESA 3	115	5962.5
528076	CV-WALTCYN 3	115	3806.5
528079	CV-CONEBUTE3	115	2857.4
528093	7-RIVERS 2	69	2129.1
528094	7-RIVERS 3	115	6715
528095	7-RIVERS 6	230	4928.1
528109	CV-LAKEWOOD3	115	5368.5
528116	CV-IRISHHIL3	115	5389.9
528132	OCOTILLO 3	115	4780.8
528137	N_CANAL 3	115	6350.9
528151	FIESTA 3	115	6928.2
528159	CARLSBAD 2	69	3730.4
528160	CARLSBAD 3	115	7724.3
528178	PECOS 3	115	8110.4
528179	PECOS 6	230	5097.9
528182	NORTH_LOVNG3	115	1975.6
528226	HOPI_SUB 3	115	3337.8
584960	GEN-2015-058	115	5852.5
599960	EPTNP-D6	230	6489.7

Table 4-5
Short Circuit Analysis for Study Project GEN-2015-068 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511422	FLETCHR4	138	7589.2	515802	GRACMNT4	138	25632.7	525413	LAMTON 2	69	5213.4
511423	FLE TAP4	138	8271.1	515997	WWPAR4	138	15920.7	525414	LAMTON 3	115	7770.7
511431	LWS S4	138	10517.9	520814	ANADARK4	138	27916.4	525432	SP-HALFWAY 2	69	5856.1
511436	COMANC-2	69	9636.9	521089	WASHITA4	138	24244.5	525440	LC-S_OLTON 3	115	7404
511437	COMANC-4	138	17265.1	521157	HUGO 7	345	10734.1	525446	SPGLAKE_TP3	115	10518.1
511439	LWSTAP 4	138	10946.1	522819	LP-NORTHEST2	69	10075.1	525453	HALE_CNTY 2	69	6899
511456	O.K.U.-7	345	5032.3	522822	LP-NORTHWST2	69	4338.8	525454	HALE_CNTY 3	115	10097.3
511466	L.E.S.-2	69	16256.7	522823	LP-MILWAKEE6	230	9755.8	525460	NEWHART 3	115	15057.7
511467	L.E.S.-4	138	22938.6	522828	LP-MILWAKEE2	69	7473.7	525461	NEWHART 6	230	10798.4
511468	L.E.S.-7	345	11981.4	522832	LP-VICKSBRG2	69	11413.8	525480	PLANT_X 3	115	20827.9
511469	LGORE-N2	69	7919	522857	LP-SOUTHEST2	69	21391.3	525481	PLANT_X 6	230	21995.3
511470	LGORE-S2	69	6880.4	522861	LP-SOUTHEST6	230	13530.3	525524	TOLK_EAST 6	230	25460.3
511474	SHERID4	138	11739	522866	LP-COOK 2	69	30408.2	525531	TOLK_WEST 6	230	25460.3
511477	S.W.S.-4	138	26826.8	522870	LP-HOLLY 6	230	14518.9	525543	TOLK_TAP 6	230	25460.3
511486	ELGINJT4	138	9632.4	522879	LP-WADSWRTH2	69	19602.8	525549	TOLK 7	345	6945
511487	ELGINJT2	69	8381.6	522888	LP-WADSWRTH6	230	11881.2	525636	LAMB_CNTY 3	115	8481
511488	112GORE4	138	11891.3	523309	MOORE_CNTY 6	230	6688	525637	LAMB_CNTY 6	230	5321.3
511494	COMMTAP4	138	20257.1	523869	CHAN/TASCOS6	230	3841.2	525724	COUNTYLINE 2	69	2200
511512	RPPAPER4	138	11280.4	523959	POTTER_CO 6	230	20175.2	525731	SP-ABERNTHY2	69	3006.7
511537	ARTVLTP4	138	11144.7	523961	POTTER_CO 7	345	7416.2	525738	HALECENTER 2	69	2454.5
511553	CHISHOLM7	345	5810.1	523979	HARRNG_EST 6	230	25896	525745	LH-HALECTR 2	69	2426.9
511557	CHISHOLM6	230	8153.1	524010	ROLLHILLS 6	230	19211.2	525769	BARWISE 2	69	3750.8
511563	ELSWORTH 4	138	9559.3	524044	NICHOLS 6	230	25163.5	525779	FLOYD_CNTY 2	69	5288
514782	WODWRD 2	69	10540.5	524267	BUSHLAND 6	230	9619.4	525780	FLOYD_CNTY 3	115	5987.7
514785	WOODWRD4	138	11893.5	524365	RANDALL 6	230	14180.3	525790	FLOYDADA_TP2	69	2489.8
514787	DEWEY 4	138	7130.1	524414	AMA_SOUTH 3	115	16539.6	525811	LH-HARMONY 2	69	4234.4
514796	IODINE-4	138	7072.9	524415	AMA_SOUTH 6	230	13372.7	525816	TUCO_INT2 2	69	4646.9
514801	MINCO 7	345	16114.7	524622	DEAFSMITH 3	115	11935.5	525826	TUCO_INT 2	69	7838.1
514809	JOHNCO 7	345	8797.2	524623	DEAFSMITH 6	230	7691.4	525828	TUCO_INT 3	115	19190.2
514901	CIMARON7	345	29441.8	524746	CASTRO_CNTY3	115	11616.8	525830	TUCO_INT 6	230	19769.1
515135	SUNNYSD4	138	16891.3	524770	PLSNT_HILL 6	230	5976.4	525832	TUCO_INT 7	345	10625.9
515136	SUNNYSD7	345	9829.9	524875	OASIS 6	230	7168.1	525840	ANTELOPE_1 6	230	19618.7
515363	CENT 4	138	3033.8	524908	ROOSEVELT 3	115	10063.5	525853	LH-WIL&ELLN2	69	2573.8
515375	WWRDEHV7	345	16032.5	524909	ROSEVELT_N 6	230	8593.4	525860	SP-BECTON 2	69	2281.2
515376	WWRDEHV4	138	21063.9	524911	ROSEVELT_S 6	230	8593.4	525885	SP-NEWDEAL 2	69	3372.2
515394	KEENAN 4	138	7772.5	524915	SW_4K33 6	230	8593.4	525892	WHITE&MONRO2	69	2548.8
515398	OUSPRT 4	138	8512.5	525019	EMU&VLY_TP 3	115	5085.9	525925	CROSBY 2	69	4762.9
515407	TATONGA7	345	10121	525056	BC-EARTH 3	115	8743.4	525926	CROSBY 3	115	4477.7
515444	MCNOWND7	345	16070	525124	HART_INDUST3	115	7562.8	526076	STANTON_W 3	115	9282.8
515448	CRSRDSW7	345	7931.2	525179	TULIA_TP 3	115	6275.1	526109	SP-ERSKINE 3	115	11256.4
515458	BORDER 7	345	4943.9	525191	KRESS_INT 2	69	4426	526130	SP-CARLISLE2	69	2107
515497	MATHWSN7	345	27269.2	525192	KRESS_INT 3	115	11103.9	526146	INDIANA 3	115	9629.3
515549	MNCWND37	345	11249.7	525212	SWISHER 3	115	10258	526159	CARLISLE 2	69	2563.6
515554	BVRCNTY7	345	14104.7	525213	SWISHER 6	230	10343.3	526160	CARLISLE 3	115	13043.6
515582	SLNGWND7	345	6886.3	525225	KRESS_RURAL3	115	6221.8	526161	CARLISLE 6	230	10368.1
515585	MAMTHPW7	345	9000	525272	KISER 3	115	5071	526162	LP-DOUD_TP 3	115	11521.8
515590	PALDR2W7	345	12029.5	525291	PLAINVW_TP 2	69	6475.3	526176	LP-DOUD 3	115	8973
515599	G07621119-20	345	11596.1	525298	S_PLAINVEW 2	69	2582.1	526184	SW_6878 2	69	2158.1
515785	WINDFRM4	138	18459.8	525325	COX 2	69	3356.3	526192	MURPHY 3	115	10545.5
515800	GRACMNT7	345	14732.6	525326	COX 3	115	5864.4	526199	SP-FRANKFRD3	115	9587.4

Table 4-5 (continued)
Short Circuit Analysis for Study Project GEN-2015-068 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
526213	ALLEN 3	115	10619.3	526694	GRAHAM 3	115	2677.9	583090	G1149&G1504	345	4532.3
526267	LUBBCK_STH 2	69	4344.1	526736	TERRY_CNTY 3	115	10516.9	583340	GEN-2012-020	230	8741.8
526268	LUBBCK_STH 3	115	18636.3	527656	CROSSROADS 7	345	5397	583370	GEN-2012-024	345	10785.7
526269	LUBBCK_STH 6	230	17070.7	529304	OMDUNCN4	138	6586.7	583760	GEN-2013-030	345	11563.6
526284	PLANTERS 2	69	6293.2	532796	WICHITA7	345	23633.2	583819	ASGI2014-001	115	11256.4
526297	LUBBCK_EST 2	69	7999.4	539638	FLATRDG4	138	14549.9	584070	GEN-2014-057	345	6144.5
526298	LUBBCK_EST 3	115	15011.8	539800	CLARKCOUNTY7	345	12538.3	584640	GEN-2015-022	115	10258
526299	LUBBCK_EST 6	230	12694.2	539801	THISTLE7	345	15121.3	584659	G15024G15025	345	6737.1
526310	CLUTTER 2	69	5429.7	539803	IRONWOOD7	345	12761.2	584700	GEN-2015-029	345	7179.6
526337	JONES 6	230	19267.5	539804	THISTLE4	138	16199.9	584750	GEN-2015-031	230	7633.6
526434	SUNDOWN 3	115	11207.8	560000	G11-14-TAP	345	12878.8	585060	GEN-2015-068	345	8867.9
526435	SUNDOWN 6	230	10471.7	560002	IRONWOOD7	345	12794.7	585080	GEN-2015-071	345	5386.5
526460	AMOCO_SS 6	230	9117.5	560010	G14-037-TAP	345	15104	585120	GEN-2015-075	69	1543.8
526475	YUMA_INT 3	115	10863.8	560013	G14-057T	345	9351.6	585270	GEN-2015-093	345	9027.8
526481	SP-WOLF_TP 3	115	11038.5	560033	G1524&G1525T	345	19063.3	585280	GEN-2015-092	345	5964
526524	WOLFFORTH 3	115	11356.5	560050	G15-031-TAP	230	8939.7	585410	GREAT_WESTRN	345	9075.7
526525	WOLFFORTH 6	230	12794.7	562004	G11-025-TAP	115	4584.4	585420	COWBOY_RIDGE	345	7166.2
526562	SLATON 2	69	2476.3	562075	G15-081-TAP	345	10552.4	585430	PRSIMN_CRK1	345	10374.3
526602	SP-WOODROW 3	115	9298.8	562480	G13-027-TAP	230	8858.4	585440	PRSIMN_CRK2	345	9567.1
526656	LYNN_CNTY 3	115	5599.5	578542	GEN-2010-001	345	11600.6	590001	OKLEHV24	138	4790.3
526676	GRASSLAND 3	115	6093.9	581112	GEN-2011-014	345	11601.6	590003	OKLEHV14	138	4801.4
526677	GRASSLAND 6	230	6360.2	581137	GEN-2011-025	115	4584.4	599891	OKLAUN 7	345	4042.1
526679	CIRRUS_WND 6	230	4970.3	582008	GEN-2011-008	345	10427	599955	PNM-DC6	230	8593.4

Table 4-6
Short Circuit Analysis for Study Project GEN-2015-075 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5032.3
515458	BORDER 7	345	4943.9
522822	LP-NORTHWST2	69	4338.8
522823	LP-MILWAKEE6	230	9755.8
522828	LP-MILWAKEE2	69	7473.7
522832	LP-VICKSBRG2	69	11413.8
522861	LP-SOUTHEST6	230	13530.3
522870	LP-HOLLY 6	230	14518.9
524911	ROSEVELT_S 6	230	8593.4
525212	SWISHER 3	115	10258
525213	SWISHER 6	230	10343.3
525454	HALE_CNTY 3	115	10097.3
525461	NEWHART 6	230	10798.4
525481	PLANT_X 6	230	21995.3
525524	TOLK_EAST 6	230	25460.3
525543	TOLK_TAP 6	230	25460.3
525780	FLOYD_CNTY 3	115	5987.7
525816	TUCO_INT2 2	69	4646.9
525826	TUCO_INT 2	69	7838.1
525828	TUCO_INT 3	115	19190.2
525830	TUCO_INT 6	230	19769.1
525832	TUCO_INT 7	345	10625.9
525840	ANTELOPE_1 6	230	19618.7
526076	STANTON_W 3	115	9282.8
526109	SP-ERSKINE 3	115	11256.4
526130	SP-CARLISLE2	69	2107
526146	INDIANA 3	115	9629.3
526159	CARLISLE 2	69	2563.6
526160	CARLISLE 3	115	13043.6
526161	CARLISLE 6	230	10368.1
526162	LP-DOUD_TP 3	115	11521.8
526176	LP-DOUD 3	115	8973
526184	SW_6878 2	69	2158.1
526192	MURPHY 3	115	10545.5
526199	SP-FRANKFRD3	115	9587.4
526205	IVORY 2	69	3925.6
526213	ALLEN 3	115	10619.3
526221	BATTON_N 2	69	1775.2
526228	BATTON_S 2	69	2712.6
526243	SP-QUAKER 3	115	9640
526256	IVORY_TP 2	69	3921.8
526267	LUBBCK_STH 2	69	4344.1
526268	LUBBCK_STH 3	115	18636.3
526269	LUBBCK_STH 6	230	17070.7
526298	LUBBCK_EST 3	115	15011.8
526299	LUBBCK_EST 6	230	12694.2
526337	JONES 6	230	19267.5
526434	SUNDOWN 3	115	11207.8
526435	SUNDOWN 6	230	10471.7
526460	AMOCO_SS 6	230	9117.5
526469	SP-YUMA 2	69	3059.3
526475	YUMA_INT 3	115	10863.8
526481	SP-WOLF_TP 3	115	11038.5
526483	SP-WOLFORTH3	115	8591.4
526524	WOLFFORTH 3	115	11356.5
526525	WOLFFORTH 6	230	12794.7
526677	GRASSLAND 6	230	6360.2
526736	TERRY_CNTY 3	115	10516.9
560050	G15-031-TAP	230	8939.7
583340	GEN-2012-020	230	8741.8
583810	ASGI2013-006	115	8591.4
583819	ASGI2014-001	115	11256.4
585060	GEN-2015-068	345	8867.9
585120	GEN-2015-075	69	1543.8

Table 4-7
Short Circuit Analysis for Study Project GEN-2015-079 and GEN-2015-080 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524623	DEAFSMITH 6	230	7691.4
524770	PLSNT_HILL 6	230	5976.4
524908	ROOSEVELT 3	115	10063.5
524909	ROSEVELT_N 6	230	8593.4
524911	ROSEVELT_S 6	230	8593.4
524915	SW_4K33 6	230	8593.4
525461	NEWHART 6	230	10798.4
525480	PLANT_X 3	115	20827.9
525481	PLANT_X 6	230	21995.3
525524	TOLK_EAST 6	230	25460.3
525531	TOLK_WEST 6	230	25460.3
525543	TOLK_TAP 6	230	25460.3
525549	TOLK 7	345	6945
525636	LAMB_CNTY 3	115	8481
525637	LAMB_CNTY 6	230	5321.3
526036	LC-OPDYKE 3	115	5767.3
526161	CARLISLE 6	230	10368.1
526269	LUBBCK_STH 6	230	17070.7
526352	LEHMAN 3	115	5962.3
526424	PACIFIC 3	115	9508.9
526434	SUNDOWN 3	115	11207.8
526435	SUNDOWN 6	230	10471.7
526445	AMOCO_TP 3	115	10569.1
526460	AMOCO_SS 6	230	9117.5
526491	LG-CLAUENE 3	115	8910.5
526524	WOLFFORTH 3	115	11356.5
526525	WOLFFORTH 6	230	12794.7
526735	TERRY_CNTY 2	69	6993.5
526736	TERRY_CNTY 3	115	10516.9
526784	AMOCOWASSON6	230	9641.1
526792	PRENTICE 3	115	5770.9
526928	PLAINS_INT 3	115	9221.1
526934	YOAKUM 3	115	14686.8
526935	YOAKUM 6	230	11681.3
526944	LG-PLAINS 3	115	7552.8
527010	OXYBRU_TP 6	230	9864.8
527018	BENNETT 3	115	12085.7
527036	SHELL_C2 3	115	12008.3
527041	ARCO_TP 3	115	12002.1
527046	OXY_WILRD2 3	115	9780.6
527047	OXY_WILRD1 3	115	9802.6
527051	ODC_TP 3	115	12100.1
527062	SHELL_CO2 3	115	14460.4
527080	EL_PASO 3	115	14281.8
527105	SAN_ANDS_TP3	115	15025.9
527125	DENVER_CTY 2	69	8387
527130	DENVER_N 3	115	18670
527136	DENVER_S 3	115	18670
527146	MUSTANG 3	115	19884.9
527149	MUSTANG 6	230	10298.3
527151	GS-MUSTANG 6	230	10298.3
527194	LG-PLSHILL 3	115	7201.6
527201	SEAGRAVES 2	69	5303.8
527202	SEAGRAVES 3	115	8142.9
527238	ROZ 3	115	8561.9
527242	AMERADA 3	115	8651.5
527262	SULPHUR 3	115	5547.8
527275	SEMINOLE 3	115	10369.9
527276	SEMINOLE 6	230	6105.2
527284	RUSSELL 3	115	8733.7
527286	XTO_RUSSEL 3	115	9606.9
527322	GAINES 3	115	8073
527340	DOSS 3	115	6758.6
527362	JOHNSON_DRW3	115	10070
527363	HIGG 3	115	9770.6
527483	CHAVES_CNTY6	230	3962.3
527597	TWEEDY 3	115	4660.8
527711	EAGLE_CREEK3	115	6775.2
527793	EDDY_STH 3	115	10033
527798	EDDY_NTH 3	115	10033
527799	EDDY_NORTH 6	230	7132.3
527800	EDDY_SOUTH 6	230	7132.3
527802	EDDY_CNTY 7	345	4061.2
527809	CV-8_MILE 3	115	5031.5
527864	CUNNINHAM 3	115	24969.3
527865	CUNNINHAM 6	230	14228.5
527891	HOBBS_INT 3	115	28219.9
527894	HOBBS_INT 6	230	14502.3
527930	PCA 3	115	8011.8
527961	POTASH_JCT 2	69	6882.2
527962	POTASH_JCT 3	115	8538.3
527963	POTASH_JCT 6	230	6124
527999	INTREPDW_TP3	115	7799.9
528025	RDRUNNER 3	115	5812
528027	RDRUNNER 6	230	3529.8
528094	7-RIVERS 3	115	7400.6
528095	7-RIVERS 6	230	5404.2
528160	CARLSBAD 3	115	8543.9
528178	PECOS 3	115	8996.3
528179	PECOS 6	230	5564.5
528317	ENRON_TP 3	115	6202.6
528325	LE-WAITS 3	115	6562.2
528333	LE-WEST_SUB3	115	8427.7
528334	LE-LOVINTON3	115	8340.2
528348	BUCKEYE_TP 3	115	7998
528355	MADDOX 3	115	24210
528385	BUCKEYE 3	115	7215.7
528392	PEARLE 3	115	6088.7
528394	QUAHADA 3	115	7154.7
528399	LEA_NATIONL3	115	6232.6
528413	TAYLOR 3	115	13597.8
528422	DCP_ZIA TP 3	115	6296.8
528433	NEW_NHOBBS 3	115	7776.8
528435	MILLEN 3	115	11037.2
528442	NE_HOBBS 3	115	11298.2
528463	SANGER_SW 3	115	14964.8
528484	SW_4J44 3	115	10481.4
528491	MONUMENT 3	115	14442.1
528498	W_HOBBS 3	115	10951.2
528568	MONUMNT_TP 3	115	9457.8
528575	OXYPERMIAN 3	115	14390.2
528582	BYRD 3	115	7609.7
528589	DRINKARD 3	115	6818.5
528602	ANDREWS 3	115	7721.6
528603	NA_ENRICH 3	115	7696.1
528604	ANDREWS 6	230	5706.4
528605	TARGA 3	115	6352.3
528618	LE-LOVINTON2	69	7141.9
528626	LE-PLNSINT 2	69	4300.4
528627	LE-TXACO_TP3	115	6918.5
528740	LE-PLANS_TP2	69	3573.5
560058	G15-077-TAP	115	8045.6
560059	G1579&G1580T	230	8255.2
562480	G13-027-TAP	230	8858.4
583840	GEN-2013-027	230	8415.7
585160	G1579&G1580	230	7875.3
599960	EPTNP-D6	230	7132.3

4.3 Short Circuit Results: 2025 Summer Peak

The maximum fault current for each bus is provided for the 2025 Summer Peak conditions. The following tables show the short circuit results for the study generators for the 2025 Summer Peak conditions:

- Table 4-8: Short Circuit Analysis for GEN-2015-020 (25SP)
- Table 4-9: Short Circuit Analysis for GEN-2015-031 (25SP)
- Table 4-10: Short Circuit Analysis for GEN-2015-056 (25SP)
- Table 4-11: Short Circuit Analysis for GEN-2015-058 (25SP)
- Table 4-12: Short Circuit Analysis for GEN-2015-068 (25SP)
- Table 4-13: Short Circuit Analysis for GEN-2015-075 (25SP)
- Table 4-14: Short Circuit Analysis for GEN-2015-079 and GEN-2015-080 (25SP)

Table 4-8
Short Circuit Analysis for Study Project GEN-2015-020 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524486	CAPROCK 3	115	3216.5
524502	NORTON 3	115	3311
524509	FE-TUCMCARI3	115	2602
524662	PARMER_CO 3	115	4093.2
524669	DS-#20 3	115	4806.5
524764	NORRIS_TP 3	115	10467.6
524768	PLSNT_HILL 3	115	9816.4
524770	PLSNT_HILL 6	230	6061.9
524773	E_CLOVIS 3	115	8414.9
524776	N_CLOVIS_TP3	115	7129
524777	N_CLOVIS 3	115	6459.1
524783	W_CLOVIS 2	69	2412.1
524784	W_CLOVIS 3	115	6085.7
524790	CANNON_TP 3	115	5792.6
524794	CANNONAFB 3	115	5445.4
524797	PERIMETER 3	115	6305.6
524801	NORRIS 3	115	9619
524808	FE-CLVS_INT3	115	6653.5
524821	CURRY 2	69	4340.1
524822	CURRY 3	115	10494.6
524831	FE-HOLLAND 3	115	8667.3
524838	FE-CLOVIS2 3	115	9953.8
524846	FARWELL 2	69	2078.5
524863	FE-CHZPLT 3	115	7636.1

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524874	OASIS 3	115	9497.9
524875	OASIS 6	230	7270.3
524885	SN_JUAN_TAP6	230	4660.4
524889	SN_JUAN_WND6	230	4470.3
524908	ROOSEVELT 3	115	10218.7
524909	ROSEVELT_N 6	230	8724.2
524911	ROSEVELT_S 6	230	8724.2
524915	SW_4K33 6	230	8724.2
524923	PORTALES 2	69	7097.4
524924	PORTALES 3	115	7194.3
524929	RO-PORT_MTR2	69	7097.4
524934	ZODIAC 2	69	5291.3
524935	KILGORE 3	115	5908.9
524941	PORTALES#1 2	69	5479.5
524948	PORTALES#2 2	69	4667.3
524962	S_PORTALES 2	69	4160.1
524963	S_PORTALES 3	115	5558.9
524976	MARKET_ST 2	69	3943.8
524977	MARKET_ST 3	115	5480.4
525019	EMU&VLY_TP 3	115	6425.3
525027	BAILEYCO 2	69	5552.7
525028	BAILEYCO 3	115	6366.1
525040	BAILEY_PMP 3	115	4886.1
525481	PLANT_X 6	230	23246.9

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
525524	TOLK_EAST 6	230	26251.4
525531	TOLK_WEST 6	230	26251.4
525543	TOLK_TAP 6	230	26251.4
525637	LAMB_CNTY 6	230	5535.8
525830	TUCO_INT 6	230	22751.4
527482	CHAVES_CNTY3	115	6292.1
527483	CHAVES_CNTY6	230	4064.8
527501	URTON 3	115	5326.4
527508	PRICE 3	115	4945.1
527546	SAMSON 3	115	5057.2
527793	EDDY_STH 3	115	10906.7
527799	EDDY_NORTH 6	230	7716.6
527800	EDDY_SOUTH 6	230	7716.6
527802	EDDY_CNTY 7	345	4243.5
562480	G13-027-TAP	230	9023.3
583280	ASGI2012-002	115	1040.4
583310	GEN-2013-022	115	3237.7
583950	GEN-2014-033	115	6230.4
583960	G14034G14035	115	5962.2
584620	GEN-2015-020	115	9261.5
599955	PNM-DC6	230	8724.2
599960	EPTNP-D6	230	7716.6

Table 4-9
Short Circuit Analysis for Study Project GEN-2015-031 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5113.7
511468	L.E.S.-7	345	12252.5
515375	WWRDEHV7	345	18274.2
515458	BORDER 7	345	5065.3
522800	MU-TULIA 3	115	5094.7
522823	LP-MILWAKEE6	230	12928.1
522828	LP-MILWAKEE2	69	8296.4
522861	LP-SOUTHEST6	230	16987.7
522866	LP-COOK 2	69	34934.3
522870	LP-HOLLY 6	230	16814.8
522888	LP-WADSWRTH6	230	12534.3
523095	HITCHLAND 6	230	14854.7
523097	HITCHLAND 7	345	15577.1
523221	XIT_INTG 6	230	2598.4
523267	PRINGLE 6	230	4261.7
523308	MOORE_E 3	115	10996.2
523309	MOORE_CNTY 6	230	6694.5
523332	EXELL_TP 3	115	4807.9
523339	FAIN 3	115	5274.2
523344	BLKHAWK_W 3	115	11819.5
523377	RIVERVIEW 3	115	13297.4
523410	CRMWA_#4 3	115	9707.5
523485	CAMX/AGR TP3	115	13945.9
523494	MEREDITH 3	115	7724.4
523543	HUTCHISON 2	69	9048.7
523544	HUTCH_N 3	115	15642.2
523546	HUTCH_S 3	115	15642.2
523551	HUTCHISON 6	230	7197.6
523636	GRAY_CNTY 3	115	3897.3
523748	BOWERS 3	115	6783.4
523770	GRAPEVINE 3	115	7769.3
523771	GRAPEVINE 6	230	5573.1
523776	WHEELER 3	115	6155.2
523777	WHEELER 6	230	5397.3
523779	STLN-DEMARC6	230	6106.7
523815	LLANO_WND 3	115	9423.4
523817	MIDSTRM_TP 3	115	6706.9
523869	CHAN/TASCOS6	230	3843
523928	MARTIN 3	115	7883.8
523931	HIGHLAND_TP3	115	11519
523959	POTTER_CO 6	230	20228.1
523961	POTTER_CO 7	345	7429.6
523977	HARRNG_WST 6	230	25977
523978	HARRNG_MID 6	230	25977
523979	HARRNG_EST 6	230	25977
524007	ROLLHILLS 3	115	19319.4
524009	CHERRY 3	115	18477.7
524010	ROLLHILLS 6	230	19257.8
524016	ASARCO 3	115	26467.2
524018	ASARCO_TP 3	115	28623

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524043	NICHOLS 3	115	30588.4
524044	NICHOLS 6	230	25240.3
524058	WHITAKER 3	115	21902.9
524079	CONWAY 3	115	4993.5
524088	KIRBY 3	115	5386.2
524106	NORTHWEST 3	115	11255.3
524136	HASTINGS 3	115	13712.4
524162	EAST_PLANT 3	115	22903.6
524163	EAST_PLANT 6	230	13650.1
524185	PIERCE_TP 3	115	19006.7
524224	MANHATTAN 3	115	18427.2
524266	BUSHLAND 3	115	9330.3
524267	BUSHLAND 6	230	9640.5
524282	34TH_ST 3	115	14936.3
524290	WILDOR2_JUS6	230	6605
524296	SPNSPUR_WND7	345	4452.4
524306	COULTER 3	115	15164.5
524321	GEORGIA 2	69	6647.5
524322	GEORGIA 3	115	16368.2
524331	PULLMAN 3	115	7121
524338	SOUTHEAST 3	115	11022.3
524345	OSAGE 3	115	13742.5
524364	RANDALL 3	115	20976.8
524365	RANDALL 6	230	14236.7
524377	FARMERS 3	115	15082.3
524388	CROUSE_HIND3	115	15088.3
524397	ARROWHEAD 3	115	13572.5
524404	OWENSCORN 3	115	14789.2
524414	AMA_SOUTH 3	115	16590.5
524415	AMA_SOUTH 6	230	13420.4
524425	ESTACADO_TP3	115	13191.8
524432	ESTACADO 3	115	11623.3
524516	CANYON_WEST3	115	5321.6
524522	CANYON E_TP3	115	5475.9
524523	CANYON_EAST3	115	5070.9
524530	PALO_DURO 3	115	6551.8
524544	SPRING_DRW 3	115	6361.3
524622	DEAFSMITH 3	115	12167.5
524623	DEAFSMITH 6	230	7774.8
524694	DS-#22 3	115	4979.6
524734	DS-#21 3	115	10889.6
524745	CASTRO_CNTY2	69	9639.1
524746	CASTRO_CNTY3	115	11749.3
524909	ROSEVELT_N 6	230	8724.2
524911	ROSEVELT_S 6	230	8724.2
524915	SW_4K33 6	230	8724.2
525019	EMU&VLY_TP 3	115	6425.3
525050	BC-KELLEY 3	115	8589.4
525056	BC-EARTH 3	115	9142.6
525124	HART_INDUST3	115	7621.3

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
525154	HAPPY_INT 3	115	5353.9
525179	TULIA_TP 3	115	6297.3
525191	KRESS_INT 2	69	4434.7
525192	KRESS_INT 3	115	11194.4
525203	SW-KRESS 2	69	4434.7
525212	SWISHER 3	115	10332.6
525213	SWISHER 6	230	10493.8
525224	KRESS_RURL 2	69	2507.2
525225	KRESS_RURAL3	115	6253.8
525257	N_PLAINVEW 3	115	5091.9
525326	COX 3	115	5903.2
525414	LAMTON 3	115	7950.5
525446	SPGLAKE_TP3	115	11490.6
525453	HALE_CNTY 2	69	6948.5
525454	HALE_CNTY 3	115	10273.6
525460	NEWHART 3	115	15177.7
525461	NEWHART 6	230	10898.1
525480	PLANT_X 3	115	26602.8
525481	PLANT_X 6	230	23246.9
525524	TOLK_EAST 6	230	26251.4
525531	TOLK_WEST 6	230	26251.4
525543	TOLK_TAP 6	230	26251.4
525549	TOLK 7	345	7027
525614	W_LITLFLDTP3	115	8230.9
525637	LAMB_CNTY 6	230	5535.8
525731	SP-ABERNTHY2	69	3018.4
525738	HALECENTER 2	69	2462.2
525779	FLOYD_CNTY 2	69	5309
525780	FLOYD_CNTY 3	115	6032.3
525816	TUCO_INT2 2	69	4674.5
525826	TUCO_INT 2	69	7917
525828	TUCO_INT 3	115	20013.1
525830	TUCO_INT 6	230	22751.4
525832	TUCO_INT 7	345	12822.7
525840	ANTELOPE_1 6	230	22571.7
525853	LH-WIL&ELLN2	69	2582
525885	SP-NEWDEAL 2	69	3386.9
525926	CROSBY 3	115	4500
526076	STANTON_W 3	115	9483.1
526109	SP-ERSKINE 3	115	11580
526146	INDIANA 3	115	9850.2
526159	CARLISLE 2	69	2573.6
526160	CARLISLE 3	115	13498.5
526161	CARLISLE 6	230	13317.9
526162	LP-DOUD_TP 3	115	11849.7
526192	MURPHY 3	115	10773.8
526268	LUBBCK_STH 3	115	19302.7
526269	LUBBCK_STH 6	230	18880.2
526297	LUBBCK_EST 2	69	8060.8
526298	LUBBCK_EST 3	115	15378.9

Table 4-9 (continued)
Short Circuit Analysis for Study Project GEN-2015-031 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
526299	LUBBCK_EST 6	230	13422.8	526677	GRASSLAND 6	230	6516.5	583090	G1149&G1504	345	4631.2
526337	JONES 6	230	20886.5	526679	CIRRUS_WND 6	230	5064	583340	GEN-2012-020	230	9174.8
526434	SUNDOWN 3	115	11465.4	526935	YOAKUM 6	230	15333.7	584220	GEN-2014-040	115	10417.9
526435	SUNDOWN 6	230	10908.7	526936	YOAKUM_345	345	8513.6	584640	GEN-2015-022	115	10332.6
526460	AMOCO_SS 6	230	9539.6	527896	HOBBS_INT 7	345	8217.6	584750	GEN-2015-031	230	7702.2
526524	WOLFFORTH 3	115	11614.6	560050	G15-031-TAP	230	9035.6	585060	GEN-2015-068	345	10309.8
526525	WOLFFORTH 6	230	13501.3	562004	G11-025-TAP	115	4606.3	599891	OKLAUN 7	345	4042.1
526676	GRASSLAND 3	115	6161.2	562480	G13-027-TAP	230	9023.3	599955	PNM-DC6	230	8724.2

Table 4-10
Short Circuit Analysis for Study Project GEN-2015-056 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5113.7	525531	TOLK_WEST 6	230	26251.4	526935	YOAKUM 6	230	15333.7
515458	BORDER 7	345	5065.3	525543	TOLK_TAP 6	230	26251.4	526936	YOAKUM_345	345	8513.6
522823	LP-MILWAKEE6	230	12928.1	525549	TOLK 7	345	7027	527010	OXYBRU_TP 6	230	12010.1
522870	LP-HOLLY 6	230	16814.8	525608	NEW_AMHERST3	115	5310.6	527149	MUSTANG 6	230	12066.2
523959	POTTER_CO 6	230	20228.1	525614	W_LITLFLDTP3	115	8230.9	527482	CHAVES_CNTY3	115	6292.1
524267	BUSHLAND 6	230	9640.5	525635	LAMB_CNTY 2	69	6227.5	527483	CHAVES_CNTY6	230	4064.8
524622	DEAFSMITH 3	115	12167.5	525636	LAMB_CNTY 3	115	9657	527656	CROSSROADS 7	345	5469.4
524623	DEAFSMITH 6	230	7774.8	525637	LAMB_CNTY 6	230	5535.8	527793	EDDY_STH 3	115	10906.7
524768	PLSNT_HILL 3	115	9816.4	525780	FLOYD_CNTY 3	115	6032.3	527798	EDDY_NTH 3	115	10906.7
524770	PLSNT_HILL 6	230	6061.9	525816	TUCO_INT2 2	69	4674.5	527799	EDDY_NORTH 6	230	7716.6
524822	CURRY 3	115	10494.6	525826	TUCO_INT 2	69	7917	527800	EDDY_SOUTH 6	230	7716.6
524875	OASIS 6	230	7270.3	525828	TUCO_INT 3	115	20013.1	527802	EDDY_CNTY 7	345	4243.5
524885	SN_JUAN_TAP6	230	4660.4	525830	TUCO_INT 6	230	22751.4	527821	CV-DAYTON 3	115	6856.9
524908	ROOSEVELT 3	115	10218.7	525832	TUCO_INT 7	345	12822.7	527865	CUNNINHAM 6	230	17045.9
524909	ROSEVELT_N 6	230	8724.2	525840	ANTELOPE_1 6	230	22571.7	528095	7-RIVERS 6	230	5963
524911	ROSEVELT_S 6	230	8724.2	526020	HOCKLEY 3	115	5613.4	528178	PECOS 3	115	11610.1
524915	SW_4K33 6	230	8724.2	526076	STANTON_W 3	115	9483.1	560050	G15-031-TAP	230	9035.6
524924	PORTALES 3	115	7194.3	526160	CARLISLE 3	115	13498.5	560059	G1579&G1580T	230	8960.2
525019	EMU&VLY_TP 3	115	6425.3	526161	CARLISLE 6	230	13317.9	562480	G13-027-TAP	230	9023.3
525056	BC-EARTH 3	115	9142.6	526269	LUBBCK_STH 6	230	18880.2	577103	GEN-2008-022	345	5172.7
525212	SWISHER 3	115	10332.6	526298	LUBBCK_EST 3	115	15378.9	577104	G08-022-WEST	345	4850.2
525213	SWISHER 6	230	10493.8	526299	LUBBCK_EST 6	230	13422.8	583340	GEN-2012-020	230	9174.8
525446	SPGLAKE_TP3	115	11490.6	526337	JONES 6	230	20886.5	583840	GEN-2013-027	230	8563.7
525454	HALE_CNTY 3	115	10273.6	526434	SUNDOWN 3	115	11465.4	584260	GEN-2014-047	345	4411.5
525460	NEWHART 3	115	15177.7	526435	SUNDOWN 6	230	10908.7	584940	GEN-2015-056	345	4828.8
525461	NEWHART 6	230	10898.1	526460	AMOCO_SS 6	230	9539.6	585060	GEN-2015-068	345	10309.8
525480	PLANT_X 3	115	26602.8	526525	WOLFFORTH 6	230	13501.3	599955	PNM-DC6	230	8724.2
525481	PLANT_X 6	230	23246.9	526677	GRASSLAND 6	230	6516.5	599960	EPTNP-D6	230	7716.6
525524	TOLK_EAST 6	230	26251.4	526934	YOAKUM 3	115	15981.4				

Table 4-11
Short Circuit Analysis for Study Project GEN-2015-058 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
524885	SN_JUAN_TAP6	230	4660.4	527757	ARTESIA_TP 2	69	3697.5	527963	POTASH_JCT 6	230	6861.4
527482	CHAVES_CNTY3	115	6292.1	527761	ARTESIA_W 2	69	3366.3	528003	CV-DAGGR&IH2	69	1633.6
527483	CHAVES_CNTY6	230	4064.8	527762	ARTSA_CC_TP2	69	1920.3	528070	CV-AZMESA 3	115	7318.7
527552	RIAC 2	115	4527.5	527763	CV-W_ARTSIA2	69	1616.3	528076	CV-WALTCYN 3	115	4490
527564	ROSWLL_INT 3	115	5285.3	527768	ARTESIA_CC 2	69	1749.6	528079	CV-CONEBUTE3	115	3313.7
527596	RIACTWTY_TP3	115	5055.4	527772	ARTSA_SR_TP2	69	1988.7	528093	7-RIVERS 2	69	2387.3
527597	TWEEDY 3	115	4917.7	527775	ARTESIA_SR 2	69	1914.7	528094	7-RIVERS 3	115	8129.3
527656	CROSSROADS 7	345	5469.4	527785	ATOKA 2	69	2355.8	528095	7-RIVERS 6	230	5963
527664	CV-CTTNWOOD2	69	2680.3	527786	ATOKA 3	115	6950.5	528109	CV-LAKEWOOD3	115	6306.9
527678	SMITH 2	69	3838.9	527793	EDDY_STH 3	115	10906.7	528116	CV-IRISHHIL3	115	6307.9
527701	ARTESIA 2	69	3842.5	527798	EDDY_NTH 3	115	10906.7	528132	OCOTILLO 3	115	6108.8
527707	ARTESIA 3	115	6643.3	527799	EDDY_NORTH 6	230	7716.6	528137	N_CANAL 3	115	8551.8
527710	EAGLE_CREEK2	69	2312.5	527800	EDDY_SOUTH 6	230	7716.6	528151	FIESTA 3	115	9601.7
527711	EAGLE_CREEK3	115	7211.6	527802	EDDY_CNTY 7	345	4243.5	528159	CARLSBAD 2	69	4852
527715	NAVAJO_2TP 3	115	6880.3	527809	CV-8_MILE 3	115	5242.4	528160	CARLSBAD 3	115	11025.6
527717	NAVAJO_2 3	115	6800.8	527811	CV-KEWAN_TP3	115	2877.2	528178	PECOS 3	115	11610.1
527720	NAVAJO_3 3	115	6841.4	527821	CV-DAYTON 3	115	6856.9	528179	PECOS 6	230	6317.8
527733	NAVAJO_1 2	69	2167.6	527822	CV-TURKYTRK3	115	3379.2	528182	NORTH_LOVNG3	115	8355.6
527736	NAVAJO_5TP 3	115	6841.4	527864	CUNNINHAM 3	115	29304.2	528226	HOPI_SUB 3	115	6611.4
527739	NAVAJO_4 3	115	6825.9	527865	CUNNINHAM 6	230	17045.9	584960	GEN-2015-058	115	6844.1
527743	NAVAJO_5 3	115	6827.9	527894	HOBBS_INT 6	230	18681.2	599960	EPTNP-D6	230	7716.6
527747	ARTESIA_TWN2	69	2134.3	527930	PCA 3	115	11015.9				
527754	CV-ARTESIA 2	69	3114.8	527962	POTASH_JCT 3	115	14144.7				

Table 4-12
Short Circuit Analysis for Study Project GEN-2015-068 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511422	FLETCHR4	138	7802.4	515802	GRACMNT4	138	27914.2	525413	LAMTON 2	69	5261.8
511423	FLE TAP4	138	8525	515997	WWPAR4	138	16403.1	525414	LAMTON 3	115	7950.5
511431	LWS S4	138	10650.2	520814	ANADARK4	138	30929.6	525432	SP-HALFWAY 2	69	5891.6
511436	COMANC-2	69	9675.8	521089	WASHITA4	138	27468.8	525440	LC-S_OLTON 3	115	7654.5
511437	COMANC-4	138	17567	521157	HUGO 7	345	10717.3	525446	SPGLAKE_TP3	115	11490.6
511439	LWSTAP 4	138	11089.5	522819	LP-NORTHEST2	69	13114.2	525453	HALE_CNTY 2	69	6948.5
511456	O.K.U.-7	345	5113.7	522822	LP-NORTHWST2	69	4603.6	525454	HALE_CNTY 3	115	10273.6
511466	L.E.S.-2	69	16402.8	522823	LP-MILWAKEE6	230	12928.1	525460	NEWHART 3	115	15177.7
511467	L.E.S.-4	138	23549	522828	LP-MILWAKEE2	69	8296.4	525461	NEWHART 6	230	10898.1
511468	L.E.S.-7	345	12252.5	522832	LP-VICKSBRG2	69	14085.8	525480	PLANT_X 3	115	26602.8
511469	LGORE-N2	69	7959.6	522857	LP-SOUTHEST2	69	24529.7	525481	PLANT_X 6	230	23246.9
511470	LGORE-S2	69	6906.1	522861	LP-SOUTHEST6	230	16987.7	525524	TOLK_EAST 6	230	26251.4
511474	SHERID4	138	11900.9	522866	LP-COOK 2	69	34934.3	525531	TOLK_WEST 6	230	26251.4
511477	S.W.S.-4	138	33557.6	522870	LP-HOLLY 6	230	16814.8	525543	TOLK_TAP 6	230	26251.4
511486	ELGINJT4	138	9912.7	522879	LP-WADSWRTH2	69	22766.5	525549	TOLK 7	345	7027
511487	ELGINJT2	69	8470.1	522888	LP-WADSWRTH6	230	12534.3	525614	W_LITLFLDTP3	115	8230.9
511488	112GORE4	138	12064	523309	MOORE_CNTY 6	230	6694.5	525637	LAMB_CNTY 6	230	5535.8
511494	COMMTAP4	138	20723.8	523869	CHAN/TASCOS6	230	3843	525724	COUNTYLINE 2	69	2206.3
511512	RPPAPER4	138	11434.3	523959	POTTER_CO 6	230	20228.1	525731	SP-ABERNTHY2	69	3018.4
511537	ARTVLTP4	138	11292	523961	POTTER_CO 7	345	7429.6	525738	HALECENTER 2	69	2462.2
511553	CHISHOLM7	345	5851.1	523979	HARRNG_EST 6	230	25977	525745	LH-HALECTR 2	69	2434.4
511557	CHISHOLM6	230	8206.4	524010	ROLLHILLS 6	230	19257.8	525769	BARWISE 2	69	3761.2
511563	ELSWORTH 4	138	9843.5	524044	NICHOLS 6	230	25240.3	525779	FLOYD_CNTY 2	69	5309
514782	WODWRD 2	69	10591.2	524267	BUSHLAND 6	230	9640.5	525780	FLOYD_CNTY 3	115	6032.3
514785	WOODWRD4	138	12026.9	524365	RANDALL 6	230	14236.7	525790	FLOYDADA_TP2	69	2494.4
514787	DEWEY 4	138	7154.3	524414	AMA_SOUTH 3	115	16590.5	525811	LH-HARMONY 2	69	4247.8
514796	IODINE-4	138	7135.6	524415	AMA_SOUTH 6	230	13420.4	525816	TUCO_INT2 2	69	4674.5
514801	MINCO 7	345	16472.7	524622	DEAFSMITH 3	115	12167.5	525826	TUCO_INT 2	69	7917
514809	JOHNCO 7	345	8826.3	524623	DEAFSMITH 6	230	7774.8	525828	TUCO_INT 3	115	20013.1
514901	CIMARON7	345	30792.1	524746	CASTRO_CNTY3	115	11749.3	525830	TUCO_INT 6	230	22751.4
515135	SUNNYSD4	138	16938	524770	PLSNT_HILL 6	230	6061.9	525832	TUCO_INT 7	345	12822.7
515136	SUNNYSD7	345	9875	524875	OASIS 6	230	7270.3	525840	ANTELOPE_1 6	230	22571.7
515363	CENT 4	138	3040.1	524908	ROOSEVELT 3	115	10218.7	525853	LH-WIL&ELLN2	69	2582
515375	WWRDEHV7	345	18274.2	524909	ROSEVELT_N 6	230	8724.2	525860	SP-BECTON 2	69	2287.6
515376	WWRDEHV4	138	22098.3	524911	ROSEVELT_S 6	230	8724.2	525885	SP-NEWDEAL 2	69	3386.9
515394	KEENAN 4	138	7909.3	524915	SW_4K33 6	230	8724.2	525892	WHITE&MONRO2	69	2557.2
515398	OUSPRT 4	138	8677	525019	EMU&VLY_TP 3	115	6425.3	525925	CROSBY 2	69	4777.4
515407	TATONGA7	345	15424.8	525056	BC-EARTH 3	115	9142.6	525926	CROSBY 3	115	4500
515444	MCNOWND7	345	16425.9	525124	HART_INDUST3	115	7621.3	526076	STANTON_W 3	115	9483.1
515448	CRSRDSW7	345	10855.5	525179	TULIA_TP 3	115	6297.3	526109	SP-ERSKINE 3	115	11580
515458	BORDER 7	345	5065.3	525191	KRESS_INT 2	69	4434.7	526130	SP-CARLISLE2	69	2113.8
515497	MATHWSN7	345	29320.1	525192	KRESS_INT 3	115	11194.4	526146	INDIANA 3	115	9850.2
515549	MNCWND37	345	11414.5	525212	SWISHER 3	115	10332.6	526159	CARLISLE 2	69	2573.6
515554	BVRCNTY7	345	14394.7	525213	SWISHER 6	230	10493.8	526160	CARLISLE 3	115	13498.5
515582	SLNGWND7	345	8830.3	525225	KRESS_RURAL3	115	6253.8	526161	CARLISLE 6	230	13317.9
515585	MAMTHPW7	345	12906.4	525272	KISER 3	115	5096.6	526162	LP-DOUD_TP 3	115	11849.7
515590	PALDR2W7	345	12236.7	525291	PLAINVW_TP 2	69	6518.9	526176	LP-DOUD 3	115	9171.9
515599	G07621119-20	345	12582.8	525298	S_PLAINVEW 2	69	2588.8	526184	SW_6878 2	69	2165.3
515785	WINDFRM4	138	18568.4	525325	COX 2	69	3364.1	526192	MURPHY 3	115	10773.8
515800	GRACMNT7	345	15167.2	525326	COX 3	115	5903.2	526199	SP-FRANKFRD3	115	9732.1

Table 4-12 (continued)
Short Circuit Analysis for Study Project GEN-2015-068 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
526213	ALLEN 3	115	10779.2
526267	LUBBCK_STH 2	69	4365.1
526268	LUBBCK_STH 3	115	19302.7
526269	LUBBCK_STH 6	230	18880.2
526284	PLANTERS 2	69	6331.2
526297	LUBBCK_EST 2	69	8060.8
526298	LUBBCK_EST 3	115	15378.9
526299	LUBBCK_EST 6	230	13422.8
526310	CLUTTER 2	69	5457.9
526337	JONES 6	230	20886.5
526434	SUNDOWN 3	115	11465.4
526435	SUNDOWN 6	230	10908.7
526460	AMOCO_SS 6	230	9539.6
526475	YUMA_INT 3	115	11135.2
526481	SP-WOLF_TP 3	115	11325.9
526524	WOLFFORTH 3	115	11614.6
526525	WOLFFORTH 6	230	13501.3
526562	SLATON 2	69	2482
526602	SP-WOODROW 3	115	9457.5
526656	LYNN_CNTY 3	115	5655.3
526676	GRASSLAND 3	115	6161.2
526677	GRASSLAND 6	230	6516.5
526679	CIRRUS_WND 6	230	5064
526694	GRAHAM 3	115	2690.7
526736	TERRY_CNTY 3	115	10755.5
526784	AMOCOWASSON6	230	11346.8
526792	PRENTICE 3	115	5883.4
526928	PLAINS_INT 3	115	9639.4
526934	YOAKUM 3	115	15981.4
526935	YOAKUM 6	230	15333.7
526936	YOAKUM_345	345	8513.6
526944	LG-PLAINS 3	115	7804.8
527010	OXYBRU_TP 6	230	12010.1
527018	BENNETT 3	115	12650.1
527041	ARCO_TP 3	115	12563.5
527047	OXY_WILRD1 3	115	10173.9
527062	SHELL_CO2 3	115	15165
527130	DENVER_N 3	115	19701.5
527136	DENVER_S 3	115	19701.5
527146	MUSTANG 3	115	21063.4
527149	MUSTANG 6	230	12066.2
527151	GS-MUSTANG 6	230	12066.2
527194	LG-PLSHILL 3	115	7395.1
527202	SEAGRAVES 3	115	8366.2
527275	SEMINOLE 3	115	10832.9
527276	SEMINOLE 6	230	6562.2
527656	CROSSROADS 7	345	5469.4
527800	EDDY_SOUTH 6	230	7716.6
527864	CUNNINHAM 3	115	29304.2
527865	CUNNINHAM 6	230	17045.9
527891	HOBBS_INT 3	115	32447.3
527894	HOBBS_INT 6	230	18681.2
527896	HOBBS_INT 7	345	8217.6
527930	PCA 3	115	11015.9
527961	POTASH_JCT 2	69	8389.3
527962	POTASH_JCT 3	115	14144.7
527963	POTASH_JCT 6	230	6861.4
527965	KIOWA 7	345	5524.9
527999	INTREPDW_TP3	115	12302.4
528025	RDRUNNER 3	115	8831.4
528027	RDRUNNER 7	345	3766.5
528160	CARLSBAD 3	115	11025.6
528182	NORTH_LOVNG3	115	8355.6
528185	N_LOVING 7	345	4396.8
528223	CHINA_DRAW 7	345	3597.1
528333	LE-WEST_SUB3	115	8739.5
528355	MADDOX 3	115	27423.2
528433	NEW_NHOBBS 3	115	7974.4
528435	MILLEN 3	115	11572
528604	ANDREWS 6	230	6915.7
528610	GAINES_GEN 6	230	8515.2
528611	GAINESGENTP6	230	9828.6
528626	LE-PLNSINT 2	69	4350.3
529304	OMDUNCN4	138	6642.7
532796	WICHITA7	345	24606.6
539638	FLATRDG4	138	14765.3
539800	CLARKCOUNTY7	345	12630.4
539801	THISTLE7	345	15498.6
539803	IRONWOOD7	345	12834.7
539804	THISTLE4	138	16435.6
560000	G11-14-TAP	345	13262.2
560002	IRONWOOD7	345	12868.8
560010	G14-037-TAP	345	15302
560013	G14-057T	345	9450
560033	G1524&G1525T	345	19604.2
560050	G15-031-TAP	230	9035.6
560059	G1579&G1580T	230	8960.2
562004	G11-025-TAP	115	4606.3
562075	G15-081-TAP	345	15345.8
562480	G13-027-TAP	230	9023.3
578542	GEN-2010-001	345	11792.7
581112	GEN-2011-014	345	11909.6
581137	GEN-2011-025	115	4606.3
582008	GEN-2011-008	345	10483.4
583090	G1149&G1504	345	4631.2
583340	GEN-2012-020	230	9174.8
583370	GEN-2012-024	345	10853.3
583760	GEN-2013-030	345	11749.5
583819	ASGI2014-001	115	11580
583840	GEN-2013-027	230	8563.7
584070	GEN-2014-057	345	6181.9
584640	GEN-2015-022	115	10332.6
584659	G15024G15025	345	6788.3
584700	GEN-2015-029	345	9421.9
584750	GEN-2015-031	230	7702.2
585060	GEN-2015-068	345	10309.8
585080	GEN-2015-071	345	5420.7
585120	GEN-2015-075	69	1547.5
585160	G1579&G1580	230	8514.4
585270	GEN-2015-093	345	9182.6
585280	GEN-2015-092	345	5999
585410	GREAT_WESTRN	345	9618.6
585420	COWBOY_RIDGE	345	7484.5
585430	PRSIMN_CRK1	345	11144.5
585440	PRSIMN_CRK2	345	10214.8
590001	OKLEHV24	138	4790.3
590003	OKLEHV14	138	4801.4
599891	OKLAUN 7	345	4042.1
599955	PNM-DC6	230	8724.2

Table 4-13
Short Circuit Analysis for Study Project GEN-2015-075 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5113.7	525840	ANTELOPE_1 6	230	22571.7	526299	LUBBCK_EST 6	230	13422.8
515458	BORDER 7	345	5065.3	526076	STANTON_W 3	115	9483.1	526337	JONES 6	230	20886.5
522822	LP-NORTHWST2	69	4603.6	526109	SP-ERSKINE 3	115	11580	526434	SUNDOWN 3	115	11465.4
522823	LP-MILWAKEE6	230	12928.1	526130	SP-CARLISLE2	69	2113.8	526435	SUNDOWN 6	230	10908.7
522828	LP-MILWAKEE2	69	8296.4	526146	INDIANA 3	115	9850.2	526460	AMOCO_SS 6	230	9539.6
522832	LP-VICKSBRG2	69	14085.8	526159	CARLISLE 2	69	2573.6	526469	SP-YUMA 2	69	3071.2
522857	LP-SOUTHEST2	69	24529.7	526160	CARLISLE 3	115	13498.5	526475	YUMA_INT 3	115	11135.2
522861	LP-SOUTHEST6	230	16987.7	526161	CARLISLE 6	230	13317.9	526481	SP-WOLF_TP 3	115	11325.9
522870	LP-HOLLY 6	230	16814.8	526162	LP-DOUD_TP 3	115	11849.7	526483	SP-WOLFORTH3	115	8764.2
524911	ROSEVELT_S 6	230	8724.2	526176	LP-DOUD 3	115	9171.9	526524	WOLFFORTH 3	115	11614.6
525212	SWISHER 3	115	10332.6	526184	SW_6878 2	69	2165.3	526525	WOLFFORTH 6	230	13501.3
525213	SWISHER 6	230	10493.8	526192	MURPHY 3	115	10773.8	526677	GRASSLAND 6	230	6516.5
525454	HALE_CNTY 3	115	10273.6	526199	SP-FRANKFRD3	115	9732.1	526736	TERRY_CNTY 3	115	10755.5
525461	NEWHART 6	230	10898.1	526205	IVORY 2	69	3942.8	526936	YOAKUM_345	345	8513.6
525481	PLANT_X 6	230	23246.9	526213	ALLEN 3	115	10779.2	560050	G15-031-TAP	230	9035.6
525524	TOLK_EAST 6	230	26251.4	526221	BATTON_N 2	69	1780.1	583340	GEN-2012-020	230	9174.8
525543	TOLK_TAP 6	230	26251.4	526228	BATTON_S 2	69	2720.8	583810	ASGI2013-006	115	8764.2
525780	FLOYD_CNTY 3	115	6032.3	526243	SP-QUAKER 3	115	9774.7	583819	ASGI2014-001	115	11580
525816	TUCO_INT2 2	69	4674.5	526256	IVORY_TP 2	69	3938.9	585060	GEN-2015-068	345	10309.8
525826	TUCO_INT 2	69	7917	526267	LUBBCK_STH 2	69	4365.1	585120	GEN-2015-075	69	1547.5
525828	TUCO_INT 3	115	20013.1	526268	LUBBCK_STH 3	115	19302.7				
525830	TUCO_INT 6	230	22751.4	526269	LUBBCK_STH 6	230	18880.2				
525832	TUCO_INT 7	345	12822.7	526298	LUBBCK_EST 3	115	15378.9				

Table 4-14
Short Circuit Analysis for Study Project GEN-2015-079 and GEN-2015-080 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5113.7
511468	L.E.S.-7	345	12252.5
515375	WWRDEHV7	345	18274.2
515458	BORDER 7	345	5065.3
524623	DEAFSMITH 6	230	7774.8
524770	PLSNT_HILL 6	230	6061.9
524908	ROOSEVELT 3	115	10218.7
524909	ROSEVELT_N 6	230	8724.2
524911	ROSEVELT_S 6	230	8724.2
524915	SW_4K33 6	230	8724.2
525213	SWISHER 6	230	10493.8
525461	NEWHART 6	230	10898.1
525480	PLANT_X 3	115	26602.8
525481	PLANT_X 6	230	23246.9
525524	TOLK_EAST 6	230	26251.4
525531	TOLK_WEST 6	230	26251.4
525543	TOLK_TAP 6	230	26251.4
525549	TOLK 7	345	7027
525636	LAMB_CNTY 3	115	9657
525637	LAMB_CNTY 6	230	5535.8
525828	TUCO_INT 3	115	20013.1
525830	TUCO_INT 6	230	22751.4
525832	TUCO_INT 7	345	12822.7
525840	ANTELOPE_1 6	230	22571.7
526036	LC-OPDYKE 3	115	5898.5
526161	CARLISLE 6	230	13317.9
526269	LUBBCK_STH 6	230	18880.2
526337	JONES 6	230	20886.5
526352	LEHMAN 3	115	6040.4
526424	PACIFIC 3	115	9691.5
526434	SUNDOWN 3	115	11465.4
526435	SUNDOWN 6	230	10908.7
526445	AMOCO_TP 3	115	10797.6
526460	AMOCO_SS 6	230	9539.6
526491	LG-CLAUENE 3	115	9075
526524	WOLFFORTH 3	115	11614.6
526525	WOLFFORTH 6	230	13501.3
526735	TERRY_CNTY 2	69	7056
526736	TERRY_CNTY 3	115	10755.5
526784	AMOCOWASSON6	230	11346.8
526792	PRENTICE 3	115	5883.4
526928	PLAINS_INT 3	115	9639.4
526934	YOAKUM 3	115	15981.4
526935	YOAKUM 6	230	15333.7
526936	YOAKUM_345	345	8513.6
526944	LG-PLAINS 3	115	7804.8
527010	OXYBRU_TP 6	230	12010.1
527018	BENNETT 3	115	12650.1
527036	SHELL_C2 3	115	12404.3
527041	ARCO_TP 3	115	12563.5
527046	OXY_WILRD2 3	115	10150.2
527047	OXY_WILRD1 3	115	10173.9
527051	ODC_TP 3	115	12665
527062	SHELL_CO2 3	115	15165
527080	EL_PASO 3	115	14954.9
527105	SAN_ANDS_TP3	115	15710.5
527125	DENVER_CTY 2	69	8506.6
527130	DENVER_N 3	115	19701.5
527136	DENVER_S 3	115	19701.5
527146	MUSTANG 3	115	21063.4
527149	MUSTANG 6	230	12066.2
527151	GS-MUSTANG 6	230	12066.2
527194	LG-PLSHILL 3	115	7395.1
527201	SEAGRAVES 2	69	5359.6
527202	SEAGRAVES 3	115	8366.2
527238	ROZ 3	115	8875.1
527242	AMERADA 3	115	8971.5
527262	SULPHUR 3	115	5634.5
527275	SEMINOLE 3	115	10832.9
527276	SEMINOLE 6	230	6562.2
527284	RUSSELL 3	115	8939.9
527286	XTO_RUSSEL 3	115	9853.7
527322	GAINES 3	115	8301.3
527340	DOSS 3	115	6936.3
527362	JOHNSON_DRW3	115	10382.4
527363	HIGG 3	115	10029.5
527483	CHAVES_CNTY6	230	4064.8
527597	TWEEDY 3	115	4917.7
527711	EAGLE_CREEK3	115	7211.6
527793	EDDY_STH 3	115	10906.7
527798	EDDY_NTH 3	115	10906.7
527799	EDDY_NORTH 6	230	7716.6
527800	EDDY_SOUTH 6	230	7716.6
527802	EDDY_CNTY 7	345	4243.5
527809	CV-8_MILE 3	115	5242.4
527864	CUNNINHAM 3	115	29304.2
527865	CUNNINHAM 6	230	17045.9
527891	HOBBS_INT 3	115	32447.3
527894	HOBBS_INT 6	230	18681.2
527896	HOBBS_INT 7	345	8217.6
527930	PCA 3	115	11015.9
527961	POTASH_JCT 2	69	8389.3
527962	POTASH_JCT 3	115	14144.7
527963	POTASH_JCT 6	230	6861.4
527965	KIOWA 7	345	5524.9
527999	INTREPDW_TP3	115	12302.4
528025	RDRUNNER 3	115	8831.4
528027	RDRUNNER 7	345	3766.5
528094	7-RIVERS 3	115	8129.3
528095	7-RIVERS 6	230	5963
528160	CARLSBAD 3	115	11025.6
528178	PECOS 3	115	11610.1
528179	PECOS 6	230	6317.8
528182	NORTH_LOVNG3	115	8355.6
528185	N_LOVING 7	345	4396.8
528223	CHINA_DRAW 7	345	3597.1
528317	ENRON_TP 3	115	6960.4
528325	LE-WAITS 3	115	6688.6
528333	LE-WEST_SUB3	115	8739.5
528334	LE-LOVINTON3	115	8653.2
528348	BUCKEYE_TP 3	115	8399.7
528355	MADDOX 3	115	27423.2
528385	BUCKEYE 3	115	7540.8
528392	PEARLE 3	115	6393.9
528394	QUAHADA 3	115	8367.8
528399	LEA_NATIONL3	115	7003.8
528413	TAYLOR 3	115	14404
528422	DCP_ZIA TP 3	115	7221.6
528433	NEW_NHOBBS 3	115	7974.4
528435	MILLEN 3	115	11572
528442	NE_HOBBS 3	115	11854.4
528463	SANGER_SW 3	115	16066.7
528484	SW_4J44 3	115	11111.5
528491	MONUMENT 3	115	15558.4
528498	W_HOBBS 3	115	11663.2
528568	MONUMNT_TP 3	115	10056.8
528575	OXYPERMIAN 3	115	15398
528582	BYRD 3	115	8020.5
528602	ANDREWS 3	115	9013.1
528603	NA_ENRICH 3	115	9075.7
528604	ANDREWS 6	230	6915.7
528610	GAINES_GEN 6	230	8515.2
528611	GAINESGENTP6	230	9828.6
528618	LE-LOVINTON2	69	9281.2
528626	LE-PLNSINT 2	69	4350.3
528627	LE-TXACO_TP3	115	7226
528740	LE-PLANS_TP2	69	3610.4
560058	G15-077-TAP	115	8180.9
560059	G1579&G1580T	230	8960.2
562480	G13-027-TAP	230	9023.3
583090	G1149&G1504	345	4631.2
583340	GEN-2012-020	230	9174.8
583840	GEN-2013-027	230	8563.7
585060	GEN-2015-068	345	10309.8
585160	G1579&G1580	230	8514.4
599891	OKLAUN 7	345	4042.1
599960	EPTNP-D6	230	7716.6

SECTION 5: POWER FACTOR ANALYSIS

The objective of this task is to quantify the power factor at the point of interconnection for the wind farms during base case and system contingencies. SPP transmission planning practice requires interconnecting generation projects to maintain the power factor (pf) at the Point of Interconnection (POI) within +/- 0.95 pf for system intact conditions and for post-contingency conditions. This is analyzed by having the wind farm maintain a prescribed voltage schedule at the point of interconnection of 1.0 p.u. voltage.

The 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak power flows provided by SPP were examined prior to the Power Factor Analysis to ensure they contained the proposed study project modeled at 100% of the nameplate rating and any previously queued projects listed in Table 2-2. There was no suspect power flow data in the study area. The proposed study project and any previously queued projects at the same point of interconnection were turned off during the power factor analysis. The wind farm(s) were then replaced by a generator modeled at the high side bus with the same real power (MW) capability as the wind farm(s) and open limits for the reactive power set points (Mvar). The generator was set to hold the POI scheduled bus voltage. All N-1, three-phase fault contingencies from Table 2-3 were then applied and the reactive power required to maintain the bus voltage was recorded.

5.1 Approach

The upgrades that were identified in the Stability Analysis were implemented to each power case for the power factor analysis. Refer to Section 3 for the necessary upgrades.

GEN-2015-020 was disabled and a generator was placed at the study project's high side bus. The generator was modeled with PGEN = 100.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-020 were disabled. The scheduled voltage was set to 1.0328 p.u. for 2016 Winter Peak conditions, 1.00 p.u. for 2017 Summer Peak conditions, 1.0206 p.u. for 2020 Summer Peak conditions, 1.0280 p.u. for 2020 Winter Peak conditions, and 1.0213 p.u. for 2025 Summer Peak conditions.

GEN-2015-031 was disabled and a generator was placed at the study project's high side bus. The generator was modeled with PGEN = 150.53 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-031 were disabled. The scheduled voltage was set to 1.0139 p.u. for 2020 Winter Peak conditions. The scheduled voltage was set to 1.00 p.u. for 2016 Winter Peak conditions, 2017 Summer Peak conditions, 2020 Summer Peak Conditions and 2025 Summer Peak conditions.

GEN-2015-056 and GEN-2014-047 were disabled and a generator was placed at the corresponding project's high side bus. GEN-2015-056 was modeled with PGEN = 101.0 MW and GEN-2014-047 was modeled with PGEN = 40.0 MW. Both generators reactive capability was modeled with QMin = -9999 Mvar and QMax = 9999 Mvar. All buses and transformers connected from the project's high side bus to the corresponding project were disabled. The scheduled voltage was set to 1.0018 p.u. for 2016 Winter Peak conditions, 1.00 p.u. for 2017 Summer Peak conditions, 1.0093 p.u. for 2020 Summer Peak conditions, 1.0087 p.u. for 2020 Winter Peak conditions, and 1.0038 p.u. for 2025 Summer Peak conditions.

GEN-2015-058 was disabled and a generator was placed at the study project's high side bus. The generator was modeled with PGEN = 50.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-058 were disabled. The scheduled voltage was set to 1.0170 p.u. for 2016 Winter Peak conditions, 1.0215 p.u. for 2017 Summer Peak conditions, 1.0273 p.u. for 2020 Summer Peak conditions, 1.0124 p.u. for 2020 Winter Peak conditions, and 1.0279 p.u. for 2025 Summer Peak conditions.

GEN-2015-068 and the ELK generation was disabled and a generator was placed at the study project's high side bus and the ELK generation high side bus (GEN-2015-068 POI). The GEN-2015-068 generator was modeled with PGEN = 300.0 MW, Qmin = -9999 Mvar, Qmax = 9999 Mvar. The ELK generator was modeled with PGEN = 411.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to both projects were disabled. The scheduled voltage was set to 1.0078 p.u. for 2020 Summer Peak conditions and 1.0093 p.u. for 2025 Summer Peak conditions. The scheduled voltage was set to 1.00 p.u. for 2016 Winter Peak conditions, 2017 Summer Peak conditions and 2020 Winter Peak conditions.

GEN-2015-075 was disabled and a generator was placed at the study project's high side bus. The generator was modeled with PGEN = 50.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-075 were disabled. The scheduled voltage was set to 1.0138 p.u. for 2016 Winter Peak conditions, 1.0044 p.u. for 2017 Summer Peak conditions, 1.0050 p.u. for 2020 Summer Peak conditions, 1.0037 p.u. for 2020 Winter Peak conditions, and 1.0037 p.u. for 2025 Summer Peak conditions.

GEN-2015-079 and GEN-2015-080 were disabled and a generator was placed at the corresponding study project's high side bus. Both generators were modeled with PGEN = 129.2 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-079 and GEN-2015-080 were disabled. The scheduled voltage was set to 1.00 p.u. for 2016 Winter Peak conditions, 2017 Summer Peak conditions, 2020 Summer Peak conditions, 2020 Winter Peak conditions, and 2025 Summer Peak conditions.

5.2 Power Factor Analysis Results

The power factor was calculated for the 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak condition. The following tables show the power factor results for the study generators:

- Table 5-1: Power Factor Analysis for GEN-2015-020
- Table 5-2: Power Factor Analysis for GEN-2015-031
- Table 5-3: Power Factor Analysis for GEN-2015-056
- Table 5-4: Power Factor Analysis for GEN-2015-058
- Table 5-5: Power Factor Analysis for GEN-2015-068
- Table 5-6: Power Factor Analysis for GEN-2015-075
- Table 5-7: Power Factor Analysis for GEN-2015-079
- Table 5-8: Power Factor Analysis for GEN-2015-080

Note that a positive Q (Mvar) output illustrates that the generator is absorbing reactive power from the system, implying a leading power factor; a negative Q (Mvar) illustrates that the generator is supplying reactive power to the system, implying a lagging power factor.

Table 5-1
Power Factor Analysis: GEN-2015-020

Cont. No.	Case	2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
1	FLT01-3PH	0.986	Leading	17.21	0.989	Leading	14.84	0.994	Leading	10.84	0.989	Leading	14.67	0.992	Leading	12.78
2	FLT02-3PH	0.986	Leading	17.07	0.989	Leading	14.66	0.994	Leading	10.72	0.990	Leading	14.56	0.992	Leading	12.64
3	FLT03-3PH	0.984	Leading	18.23	0.988	Leading	15.72	0.992	Leading	12.96	0.985	Leading	17.60	0.991	Leading	13.16
4	FLT04-3PH	0.995	Leading	9.62	0.993	Leading	11.63	1.000	Leading	1.75	0.998	Leading	6.30	0.999	Leading	4.39
5	FLT05-3PH	0.988	Leading	15.75	0.980	Leading	20.32	0.998	Leading	7.06	0.996	Leading	9.00	0.989	Leading	14.94
6	FLT06-3PH	0.985	Leading	17.25	0.989	Leading	14.89	0.994	Leading	10.90	0.989	Leading	14.71	0.992	Leading	12.83
7	FLT07-3PH	0.985	Leading	17.24	0.989	Leading	14.86	0.994	Leading	10.87	0.989	Leading	14.70	0.992	Leading	12.82
8	FLT11-3PH	0.982	Leading	19.19	0.974	Leading	23.09	0.986	Leading	17.14	0.989	Leading	14.65	0.975	Leading	22.63
9	FLT13-3PH	0.986	Leading	17.18	0.990	Leading	14.36	0.995	Leading	10.47	0.989	Leading	14.78	0.993	Leading	12.17
10	FLT14-3PH	0.989	Leading	14.96	0.999	Lagging	-5.16	0.998	Leading	5.82	0.993	Leading	11.72	0.998	Leading	6.15
11	FLT15-3PH	0.995	Leading	10.04	0.990	Leading	14.45	0.999	Leading	3.97	0.999	Leading	4.85	0.997	Leading	7.11
12	FLT16-3PH	0.983	Leading	18.91	0.983	Leading	18.75	0.989	Leading	15.23	0.985	Leading	17.36	0.986	Leading	17.03
13	FLT17-3PH	0.987	Leading	16.11	0.990	Leading	14.06	0.994	Leading	10.98	0.991	Leading	13.64	0.992	Leading	12.87
14	FLT18-3PH	0.987	Leading	16.34	0.990	Leading	14.35	0.993	Leading	11.48	0.991	Leading	13.86	0.991	Leading	13.35
15	FLT19-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
16	FLT20-3PH	0.986	Leading	17.02	0.989	Leading	14.63	0.994	Leading	10.99	0.989	Leading	14.69	0.992	Leading	12.75
17	FLT21-3PH	0.973	Leading	23.57	0.976	Leading	22.28	0.977	Leading	21.59	0.977	Leading	21.74	0.974	Leading	23.09
18	FLT22-3PH	0.981	Leading	20.01	0.980	Leading	20.54	0.984	Leading	17.90	0.983	Leading	18.64	0.980	Leading	20.22
19	FLT23-3PH	0.982	Leading	19.17	0.982	Leading	19.33	0.987	Leading	16.28	0.985	Leading	17.74	0.984	Leading	18.28
20	FLT24-3PH	0.974	Leading	23.36	0.977	Leading	21.91	0.979	Leading	20.75	0.978	Leading	21.49	0.976	Leading	22.40
21	FLT25-3PH	0.985	Leading	17.69	0.991	Leading	13.17	0.996	Leading	9.24	0.992	Leading	12.80	0.993	Leading	11.58
22	FLT26-3PH	0.993	Leading	11.53	0.993	Leading	11.93	0.997	Leading	7.66	0.990	Leading	14.22	0.996	Leading	8.74
23	FLT27-3PH	0.987	Leading	16.07	0.991	Leading	13.28	0.995	Leading	9.80	0.990	Leading	13.98	0.994	Leading	11.38
24	FLT28-3PH	0.991	Lagging	-13.61	0.997	Leading	8.29	0.999	Leading	4.10	0.997	Lagging	-7.49	1.000	Leading	2.76
25	FLT29-3PH	0.995	Leading	9.62	1.000	Leading	2.21	1.000	Leading	0.42	0.996	Leading	8.93	0.999	Lagging	-3.40
26	FLT30-3PH	0.993	Leading	12.11	0.985	Leading	17.22	0.992	Leading	13.08	0.995	Leading	9.73	0.988	Leading	15.58
27	FLT31-3PH	0.992	Leading	12.45	0.994	Leading	10.79	0.998	Leading	7.02	0.995	Leading	10.12	0.996	Leading	9.18
28	FLT34-3PH	0.986	Leading	16.82	0.989	Leading	14.62	0.994	Leading	10.55	0.990	Leading	14.24	0.992	Leading	12.77
29	FLT35-3PH	0.986	Leading	17.13	0.989	Leading	15.09	0.994	Leading	11.02	0.989	Leading	14.71	0.992	Leading	12.94
30	FLT36-3PH	0.986	Leading	17.13	0.989	Leading	15.07	0.994	Leading	10.97	0.989	Leading	14.72	0.992	Leading	12.83
31	FLT37-3PH	0.986	Leading	16.99	0.989	Leading	15.13	0.994	Leading	10.99	0.989	Leading	14.72	0.992	Leading	12.82
32	FLT38-3PH	0.986	Leading	17.03	0.989	Leading	15.05	0.994	Leading	10.91	0.990	Leading	14.59	0.992	Leading	12.84
33	FLT39-3PH	0.985	Leading	17.45	0.989	Leading	15.11	0.994	Leading	11.00	0.989	Leading	14.84	0.992	Leading	12.86
34	FLT40-3PH	0.985	Leading	17.26	0.989	Leading	15.15	0.994	Leading	11.05	0.989	Leading	14.85	0.992	Leading	12.87
35	FLT41-3PH	0.985	Leading	17.22	0.989	Leading	15.16	0.994	Leading	11.05	0.989	Leading	14.80	0.992	Leading	12.92
36	FLT43-3PH	0.988	Leading	15.94	0.990	Leading	13.93	0.995	Leading	10.07	0.991	Leading	13.76	0.992	Leading	12.91
37	FLT45-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
38	FLT46-3PH	0.986	Leading	17.20	0.989	Leading	15.14	0.994	Leading	11.02	0.989	Leading	14.76	0.992	Leading	12.89
39	FLT47-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
40	FLT48-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
41	FLT49-3PH	0.987	Leading	16.05	0.990	Leading	13.97	0.995	Leading	10.13	0.991	Leading	13.83	0.992	Leading	12.93
42	FLT52-3PH	0.990	Leading	14.38	0.995	Leading	10.50	0.999	Leading	4.94	0.991	Leading	13.19	0.996	Leading	8.96
43	FLT54-3PH	0.988	Leading	15.42	0.992	Leading	12.40	0.997	Leading	8.27	0.991	Leading	13.20	0.996	Leading	8.46
44	FLT55-3PH	0.988	Leading	15.60	0.991	Leading	13.26	0.996	Leading	8.72	0.991	Leading	13.33	0.995	Leading	10.48
45	FLT56-3PH	0.985	Leading	17.75	0.989	Leading	14.94	0.994	Leading	10.99	0.988	Leading	15.41	0.992	Leading	12.93
46	FLT57-3PH	0.985	Leading	17.39	0.989	Leading	14.65	0.995	Leading	10.53	0.989	Leading	14.94	0.992	Leading	12.69
47	FLT58-3PH	0.985	Leading	17.79	0.989	Leading	14.91	0.994	Leading	10.98	0.988	Leading	15.45	0.992	Leading	12.92
48	FLT59-3PH	0.987	Leading	16.39	0.990	Leading	14.55	0.995	Leading	10.19	0.990	Leading	14.20	0.994	Leading	11.29
49	FLT60-3PH	0.985	Leading	17.40	0.989	Leading	14.85	0.994	Leading	10.96	0.989	Leading	15.05	0.992	Leading	13.04
50	FLT63-3PH	0.985	Leading	17.22	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.92
51	FLT64-3PH	0.986	Leading	17.20	0.989	Leading	15.14	0.994	Leading	11.05	0.989	Leading	14.82	0.992	Leading	12.87
52	FLT65-3PH	0.986	Leading	17.22	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.91
53	FLT66-3PH	0.986	Leading	17.07	0.989	Leading	15.06	0.994	Leading	11.02	0.989	Leading	14.78	0.992	Leading	12.81
54	FLT67-3PH	0.986	Leading	17.21	0.989	Leading	15.15	0.994	Leading	11.05	0.989	Leading	14.81	0.992	Leading	12.90
55	FLT68-3PH	0.986	Leading	17.21	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.91
56	FLT69-3PH	0.987	Leading	16.29	0.990	Leading	14.40	0.995	Leading	10.49	0.990	Leading	14.56	0.994	Leading	11.17
57	FLT70-3PH	0.985	Leading	17.25	0.989	Leading	15.17	0.994	Leading	11.04	0.989	Leading	14.80	0.992	Leading	12.90
58	FLT71-3PH	0.985	Leading	17.22	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.92
59	FLT72-3PH	0.985	Leading	17.26	0.989	Leading	15.20	0.994	Leading	11.03	0.989	Leading	14.82	0.992	Leading	12.94
60	FLT73-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
61	FLT74-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.94
62	FLT75-3PH	0.985	Leading	17.33	0.989	Leading	15.27	0.994	Leading	11.04	0.989	Leading	14.82	0.992	Leading	12.89
63	FLT76-3PH	0.986	Leading	17.21	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.91
64	FLT77-3PH	0.984	Leading	17.85	0.988	Leading	15.38	0.994	Leading	11.08	0.989	Leading	14.90	0.991	Leading	13.45
65	FLT84-3PH	0.986	Leading	17.07	0.989	Leading	15.07	0.994	Leading	10.85	0.989	Leading	14.62	0.992	Leading	12.94
66	FLT85-3PH	0.986	Leading	17.21	0.989	Leading	15.16	0.994	Leading	11.04	0.989	Leading	14.80	0.992	Leading	12.81
67	FLT86-3PH	0.986	Leading	17.11	0.990	Leading	14.53	0.995	Leading	10.45	0.989	Leading	14.75	0.993	Leading	12.28
68	FLT87-3PH	0.985	Leading	17.24	0.989	Leading	15.18	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.90
69	FLT88-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.07	0.989	Leading	14.83	0.992	Leading	12.97
70	FLT92-3PH	0.986	Leading	17.21	0.990	Leading	14.28	0.995	Leading	10.13	0.991	Leading	13.56	0.990	Leading	14.46

Table 5-1 (continued)
Power Factor Analysis: GEN-2015-020

	2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
FLT93-3PH	0.996	Leading	9.36	0.999	Leading	4.75	0.998	Leading	5.95	0.995	Leading	10.11	0.999	Leading	4.29
FLT94-3PH	0.986	Leading	17.21	0.990	Leading	14.28	0.995	Leading	10.13	0.991	Leading	13.56	0.990	Leading	14.53
FLT95-3PH	0.996	Leading	9.36	0.999	Leading	4.76	0.998	Leading	5.95	0.995	Leading	10.11	0.999	Leading	4.29
FLT96-3PH	0.986	Leading	17.20	0.989	Leading	15.15	0.994	Leading	11.07	0.989	Leading	14.81	0.992	Leading	12.96
FLT97-3PH	0.986	Leading	17.13	0.989	Leading	15.05	0.994	Leading	11.00	0.989	Leading	14.77	0.992	Leading	12.87
FLT98-3PH	0.986	Leading	17.21	0.989	Leading	15.14	0.994	Leading	11.05	0.989	Leading	14.80	0.992	Leading	12.91
FLT99-3PH	0.986	Leading	17.20	0.989	Leading	15.15	0.994	Leading	11.07	0.989	Leading	14.82	0.992	Leading	12.97
FLT100-3PH	0.986	Leading	17.12	0.989	Leading	15.04	0.994	Leading	10.99	0.989	Leading	14.76	0.992	Leading	12.85
FLT101-3PH	0.986	Leading	17.16	0.989	Leading	15.10	0.994	Leading	11.01	0.989	Leading	14.77	0.992	Leading	12.87
FLT102-3PH	0.985	Leading	17.22	0.989	Leading	15.16	0.994	Leading	11.08	0.989	Leading	14.83	0.992	Leading	13.02
FLT105-3PH	0.985	Leading	17.22	0.989	Leading	15.15	0.994	Leading	11.03	0.989	Leading	14.79	0.992	Leading	12.80
FLT106-3PH	0.985	Leading	17.24	0.989	Leading	15.16	0.994	Leading	11.05	0.989	Leading	14.81	0.992	Leading	12.90
FLT107-3PH	0.985	Leading	17.24	0.989	Leading	15.17	0.994	Leading	11.07	0.989	Leading	14.82	0.992	Leading	12.94
FLT108-3PH	0.985	Leading	17.25	0.989	Leading	15.18	0.994	Leading	11.08	0.989	Leading	14.81	0.992	Leading	12.97
FLT109-3PH	0.985	Leading	17.22	0.989	Leading	15.17	0.994	Leading	11.07	0.989	Leading	14.81	0.992	Leading	12.94
FLT111-3PH	0.985	Leading	17.24	0.989	Leading	15.18	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
FLT112-3PH	0.985	Leading	17.22	0.989	Leading	15.19	0.994	Leading	11.06	0.989	Leading	14.83	0.992	Leading	12.94
FLT113-3PH	0.986	Leading	17.20	0.989	Leading	15.16	0.994	Leading	11.09	0.989	Leading	14.81	0.992	Leading	12.92
FLT114-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.93
FLT115-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
FLT116-3PH	0.986	Leading	17.13	0.989	Leading	15.13	0.994	Leading	11.17	0.989	Leading	14.81	0.992	Leading	12.97
FLT117-3PH	0.985	Leading	17.26	0.989	Leading	15.20	0.994	Leading	11.03	0.989	Leading	14.81	0.992	Leading	12.93
FLT118-3PH	0.985	Leading	17.23	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.93
FLT119-3PH	0.986	Leading	17.21	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.81	0.992	Leading	12.91
FLT120-3PH	0.986	Leading	17.12	0.989	Leading	15.11	0.994	Leading	11.07	0.989	Leading	14.80	0.992	Leading	12.83
FLT121-3PH	0.985	Leading	17.24	0.989	Leading	15.17	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
FLT126-3PH	0.987	Leading	16.36	0.989	Leading	14.86	0.994	Leading	10.99	0.989	Leading	14.68	0.992	Leading	12.46
FLT127-3PH	0.985	Leading	17.24	0.989	Leading	15.16	0.994	Leading	11.06	0.989	Leading	14.82	0.992	Leading	12.94
FLT128-3PH	0.986	Leading	16.85	0.989	Leading	15.18	0.994	Leading	11.11	0.989	Leading	14.89	0.991	Leading	13.37
FLT129-3PH	0.985	Leading	17.26	0.989	Leading	15.19	0.994	Leading	11.07	0.989	Leading	14.83	0.992	Leading	12.97

Study Generator GEN-2015-020

The Power Factor Analysis shows that GEN-2015-020 has a power factor range of 0.973 leading (absorbing) to 0.991 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.974 leading (absorbing) to 0.999 lagging (supplying) to for the 2017 Summer Peak conditions, a power factor range of 0.977 leading (supplying) to 1.00 (unity) for the 2020 Summer Peak conditions, a power factor range of 0.977 leading (absorbing) to 0.997 lagging (supplying) for the 2020 Winter Peak conditions, and a power factor range of 0.974 leading (absorbing) to 0.999 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-2
Power Factor Analysis: GEN-2015-031

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
1	FLT01-3PH	0.969	Lagging	-38.37	0.982	Lagging	-29.22	0.995	Lagging	-14.92	0.999	Leading	7.00	0.974	Lagging	-34.83
2	FLT02-3PH	0.969	Lagging	-38.39	0.982	Lagging	-29.24	0.995	Lagging	-14.92	0.999	Leading	7.00	0.974	Lagging	-34.84
3	FLT03-3PH	0.969	Lagging	-38.39	0.982	Lagging	-29.23	0.995	Lagging	-15.00	0.999	Leading	6.95	0.974	Lagging	-34.83
4	FLT04-3PH	0.969	Lagging	-38.49	0.982	Lagging	-29.23	0.995	Lagging	-15.39	0.999	Leading	6.01	0.973	Lagging	-35.39
5	FLT05-3PH	0.969	Lagging	-38.14	0.982	Lagging	-28.85	0.995	Lagging	-15.18	0.999	Leading	6.59	0.974	Lagging	-34.99
6	FLT06-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.20	0.995	Lagging	-14.91	0.999	Leading	7.01	0.974	Lagging	-34.83
7	FLT07-3PH	0.969	Lagging	-38.38	0.982	Lagging	-29.22	0.995	Lagging	-14.92	0.999	Leading	7.00	0.974	Lagging	-34.83
8	FLT11-3PH	0.970	Lagging	-38.03	0.982	Lagging	-28.74	0.995	Lagging	-14.60	0.999	Leading	7.27	0.975	Lagging	-34.59
9	FLT13-3PH	0.969	Lagging	-38.37	0.982	Lagging	-29.34	0.995	Lagging	-14.95	0.999	Leading	7.00	0.974	Lagging	-34.85
10	FLT14-3PH	0.969	Lagging	-38.46	0.981	Lagging	-29.99	0.995	Lagging	-15.31	0.999	Leading	6.74	0.974	Lagging	-35.16
11	FLT15-3PH	0.968	Lagging	-39.30	0.978	Lagging	-31.85	0.994	Lagging	-16.67	0.999	Leading	6.34	0.973	Lagging	-35.72
12	FLT16-3PH	0.969	Lagging	-38.37	0.982	Lagging	-29.27	0.995	Lagging	-14.94	0.999	Leading	6.99	0.974	Lagging	-34.84
13	FLT17-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.23	0.995	Lagging	-14.87	0.999	Leading	7.02	0.974	Lagging	-34.79
14	FLT18-3PH	0.969	Lagging	-38.34	0.982	Lagging	-29.22	0.995	Lagging	-14.86	0.999	Leading	7.03	0.974	Lagging	-34.78
15	FLT19-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
16	FLT20-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.22	0.995	Lagging	-14.89	0.999	Leading	7.01	0.974	Lagging	-34.82
17	FLT21-3PH	0.969	Lagging	-38.48	0.981	Lagging	-29.40	0.995	Lagging	-15.02	0.999	Leading	6.90	0.974	Lagging	-34.89
18	FLT22-3PH	0.969	Lagging	-38.42	0.981	Lagging	-29.39	0.995	Lagging	-15.02	0.999	Leading	6.94	0.974	Lagging	-34.90
19	FLT23-3PH	0.969	Lagging	-38.39	0.982	Lagging	-29.33	0.995	Lagging	-14.98	0.999	Leading	6.97	0.974	Lagging	-34.87
20	FLT24-3PH	0.969	Lagging	-38.46	0.982	Lagging	-29.36	0.995	Lagging	-15.00	0.999	Leading	6.92	0.974	Lagging	-34.87
21	FLT25-3PH	0.969	Lagging	-38.40	0.982	Lagging	-29.29	0.995	Lagging	-14.90	0.999	Leading	7.00	0.974	Lagging	-34.85
22	FLT26-3PH	0.969	Lagging	-38.40	0.982	Lagging	-29.24	0.995	Lagging	-14.90	0.999	Leading	7.00	0.974	Lagging	-34.83
23	FLT27-3PH	0.969	Lagging	-38.40	0.982	Lagging	-29.23	0.995	Lagging	-14.90	0.999	Leading	7.02	0.974	Lagging	-34.83
24	FLT28-3PH	0.969	Lagging	-38.59	0.982	Lagging	-29.30	0.995	Lagging	-14.95	0.999	Leading	6.83	0.974	Lagging	-34.85
25	FLT29-3PH	0.969	Lagging	-38.12	0.982	Lagging	-29.15	0.995	Lagging	-14.37	0.999	Leading	7.85	0.974	Lagging	-34.74
26	FLT30-3PH	0.969	Lagging	-38.39	0.982	Lagging	-29.18	0.995	Lagging	-14.86	0.999	Leading	7.02	0.974	Lagging	-34.81
27	FLT31-3PH	0.969	Lagging	-38.43	0.982	Lagging	-29.33	0.995	Lagging	-14.97	0.999	Leading	6.95	0.974	Lagging	-34.87
28	FLT34-3PH	0.926	Lagging	-61.36	0.969	Lagging	-38.60	0.987	Lagging	-24.25	1.000	Lagging	-0.06	0.974	Lagging	-34.79
29	FLT35-3PH	0.975	Leading	33.97	0.990	Leading	21.52	0.989	Leading	22.18	0.990	Leading	21.68	0.997	Leading	11.91
30	FLT36-3PH	0.986	Lagging	-25.50	0.991	Leading	20.51	0.980	Leading	30.65	0.991	Leading	20.58	0.987	Leading	24.65
31	FLT37-3PH	0.999	Lagging	-6.43	0.974	Lagging	-35.06	0.971	Lagging	-36.80	0.990	Leading	21.91	0.942	Lagging	-53.86
32	FLT38-3PH	0.988	Lagging	-23.89	0.999	Lagging	-5.75	0.992	Leading	18.66	0.983	Leading	28.02	0.996	Lagging	-12.97
33	FLT39-3PH	0.960	Lagging	-44.02	0.983	Lagging	-28.16	0.996	Lagging	-13.89	0.999	Leading	5.66	0.977	Lagging	-33.11
34	FLT40-3PH	0.980	Lagging	-30.41	0.981	Lagging	-30.15	0.995	Lagging	-15.64	0.997	Leading	11.27	0.965	Lagging	-41.19
35	FLT41-3PH	0.974	Lagging	-34.91	0.981	Lagging	-29.82	0.995	Lagging	-15.68	0.999	Leading	6.51	0.981	Lagging	-29.91
36	FLT43-3PH	0.834	Lagging	-99.59	0.853	Lagging	-92.10	0.956	Lagging	-46.03	0.966	Lagging	-40.00	0.956	Lagging	-46.12
37	FLT45-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
38	FLT46-3PH	0.963	Lagging	-42.40	0.980	Lagging	-30.18	0.994	Lagging	-15.88	0.999	Leading	5.93	0.974	Lagging	-35.11
39	FLT47-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
40	FLT48-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
41	FLT49-3PH	0.865	Lagging	-87.24	0.874	Lagging	-83.71	0.967	Lagging	-39.46	0.977	Lagging	-32.57	0.959	Lagging	-44.55
42	FLT52-3PH	0.924	Lagging	-62.21	0.942	Lagging	-53.62	0.971	Lagging	-36.98	0.996	Lagging	-13.18	0.956	Lagging	-46.32
43	FLT54-3PH	0.897	Lagging	-74.03	0.954	Lagging	-47.45	0.984	Lagging	-27.36	0.992	Lagging	-18.77	0.968	Lagging	-39.10
44	FLT55-3PH	0.968	Lagging	-39.29	0.981	Lagging	-30.00	0.994	Lagging	-16.01	0.999	Leading	6.23	0.973	Lagging	-35.97
45	FLT56-3PH	0.969	Lagging	-38.41	0.979	Lagging	-31.01	0.995	Lagging	-15.33	0.999	Leading	7.70	0.974	Lagging	-34.81
46	FLT57-3PH	0.928	Lagging	-60.63	0.967	Lagging	-39.77	0.977	Lagging	-32.54	1.000	Lagging	-2.41	0.957	Lagging	-45.76
47	FLT58-3PH	0.969	Lagging	-38.45	0.979	Lagging	-31.18	0.995	Lagging	-15.40	0.999	Leading	7.74	0.974	Lagging	-34.85
48	FLT59-3PH	0.959	Lagging	-44.60	0.976	Lagging	-33.54	0.992	Lagging	-19.63	1.000	Leading	1.48	0.969	Lagging	-38.36
49	FLT60-3PH	0.970	Lagging	-38.01	0.982	Lagging	-28.79	0.995	Lagging	-14.89	0.999	Leading	7.50	0.975	Lagging	-34.66
50	FLT63-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.25	0.995	Lagging	-14.91	0.999	Leading	7.00	0.974	Lagging	-34.82
51	FLT64-3PH	0.969	Lagging	-38.30	0.982	Lagging	-29.18	0.995	Lagging	-14.90	0.999	Leading	7.02	0.974	Lagging	-34.76
52	FLT65-3PH	0.969	Lagging	-38.36	0.982	Lagging	-29.26	0.995	Lagging	-14.92	0.999	Leading	6.98	0.974	Lagging	-34.83
53	FLT66-3PH	0.969	Lagging	-38.44	0.981	Lagging	-29.66	0.995	Lagging	-15.22	0.999	Leading	6.62	0.974	Lagging	-35.17
54	FLT67-3PH	0.969	Lagging	-38.48	0.982	Lagging	-29.31	0.995	Lagging	-14.92	0.999	Leading	6.89	0.974	Lagging	-34.87
55	FLT68-3PH	0.969	Lagging	-38.33	0.982	Lagging	-29.22	0.995	Lagging	-14.88	0.999	Leading	7.03	0.974	Lagging	-34.82
56	FLT69-3PH	0.966	Lagging	-40.22	0.980	Lagging	-30.50	0.994	Lagging	-17.08	1.000	Leading	4.32	0.972	Lagging	-36.58
57	FLT70-3PH	0.969	Lagging	-38.59	0.981	Lagging	-29.44	0.995	Lagging	-14.94	0.999	Leading	6.93	0.974	Lagging	-34.85
58	FLT71-3PH	0.969	Lagging	-38.54	0.982	Lagging	-29.29	0.995	Lagging	-14.98	0.999	Leading	6.94	0.974	Lagging	-34.85
59	FLT72-3PH	0.969	Lagging	-38.40	0.981	Lagging	-29.43	0.995	Lagging	-15.03	0.999	Leading	7.01	0.974	Lagging	-34.83
60	FLT73-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
61	FLT74-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.33	0.995	Lagging	-15.01	0.999	Leading	6.89	0.974	Lagging	-34.85
62	FLT75-3PH	0.968	Lagging	-38.83	0.981	Lagging	-29.85	0.995	Lagging	-14.99	0.999	Leading	6.93	0.974	Lagging	-34.90
63	FLT76-3PH	0.969	Lagging	-38.32	0.982	Lagging	-29.21	0.995	Lagging	-14.88	0.999	Leading	7.03	0.974	Lagging	-34.81
64	FLT77-3PH	0.968	Lagging	-38.97	0.981	Lagging	-30.01	0.995	Lagging	-15.24	0.999	Leading	6.88	0.974	Lagging	-35.01
65	FLT84-3PH	0.963	Lagging	-42.18	0.980	Lagging	-30.22	0.992	Lagging	-18.77	1.000	Leading	1.33	0.971	Lagging	-36.85
66	FLT85-3PH	0.970	Lagging	-38.02	0.985	Lagging	-26.21	0.996	Lagging	-12.96	0.998	Leading	9.38	0.975	Lagging	-34.65
67	FLT86-3PH	0.919	Lagging	-64.42	0.972	Lagging	-36.06	0.993	Lagging	-17.63	1.000	Lagging	-0.46	0.970	Lagging	-37.74
68	FLT87-3PH	0.958	Lagging	-44.86	0.983	Lagging	-27.82	0.995	Lagging	-14.44	0.999	Leading	7.15	0.975	Lagging	-34.66
69	FLT88-3PH	0.969	Lagging	-38.17	0.981	Lagging	-30.02	0.994	Lagging	-16.01	0.999	Leading	6.98	0.973	Lagging	-35.99
70	FLT92-3PH	0.971	Lagging	-36.80	0.983	Lagging	-28.20	0.996	Lagging	-13.05	0.998	Leading	9.71	0.975	Lagging	-34.09

Table 5-2 (continued)
Power Factor Analysis: GEN-2015-031

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	0.969	Lagging	-38.18	0.982	Lagging	-29.29	0.994	Lagging	-17.20	1.000	Leading	4.33	0.971	Lagging	-36.85
72	FLT94-3PH	0.971	Lagging	-36.82	0.983	Lagging	-28.21	0.996	Lagging	-13.06	0.998	Leading	9.70	0.975	Lagging	-34.09
73	FLT95-3PH	0.969	Lagging	-38.22	0.982	Lagging	-29.32	0.994	Lagging	-17.22	1.000	Leading	4.30	0.971	Lagging	-36.86
74	FLT96-3PH	0.969	Lagging	-38.32	0.982	Lagging	-29.19	0.995	Lagging	-14.91	0.999	Leading	7.01	0.974	Lagging	-34.82
75	FLT97-3PH	0.969	Lagging	-38.38	0.982	Lagging	-29.27	0.995	Lagging	-14.91	0.999	Leading	7.00	0.974	Lagging	-34.85
76	FLT98-3PH	0.969	Lagging	-38.37	0.982	Lagging	-29.22	0.995	Lagging	-14.90	0.999	Leading	7.02	0.974	Lagging	-34.82
77	FLT99-3PH	0.969	Lagging	-38.32	0.982	Lagging	-29.19	0.995	Lagging	-14.92	0.999	Leading	7.00	0.974	Lagging	-34.83
78	FLT100-3PH	0.969	Lagging	-38.40	0.982	Lagging	-29.29	0.995	Lagging	-14.91	0.999	Leading	6.99	0.974	Lagging	-34.86
79	FLT101-3PH	0.969	Lagging	-38.39	0.982	Lagging	-29.25	0.995	Lagging	-14.92	0.999	Leading	6.99	0.974	Lagging	-34.84
80	FLT102-3PH	0.969	Lagging	-38.25	0.982	Lagging	-29.14	0.995	Lagging	-14.95	0.999	Leading	6.98	0.974	Lagging	-34.84
81	FLT105-3PH	0.970	Lagging	-37.54	0.983	Lagging	-28.52	0.995	Lagging	-14.34	0.999	Leading	7.49	0.975	Lagging	-34.60
82	FLT106-3PH	0.973	Lagging	-35.37	0.982	Lagging	-29.25	0.995	Lagging	-15.28	0.999	Leading	6.84	0.973	Lagging	-35.48
83	FLT107-3PH	0.967	Lagging	-39.37	0.981	Lagging	-29.92	0.995	Lagging	-15.65	0.999	Leading	6.71	0.973	Lagging	-35.40
84	FLT108-3PH	0.973	Lagging	-35.64	0.983	Lagging	-28.09	0.996	Lagging	-14.19	0.999	Leading	6.68	0.975	Lagging	-34.65
85	FLT109-3PH	0.969	Lagging	-38.43	0.982	Lagging	-29.25	0.995	Lagging	-14.94	0.999	Leading	6.96	0.974	Lagging	-34.84
86	FLT111-3PH	0.969	Lagging	-38.27	0.982	Lagging	-29.24	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.83
87	FLT112-3PH	0.969	Lagging	-38.26	0.982	Lagging	-29.29	0.995	Lagging	-14.91	0.999	Leading	7.00	0.974	Lagging	-34.83
88	FLT113-3PH	0.969	Lagging	-38.27	0.982	Lagging	-29.09	0.995	Lagging	-14.85	0.999	Leading	6.99	0.974	Lagging	-34.79
89	FLT114-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.29	0.995	Lagging	-14.94	0.999	Leading	7.02	0.974	Lagging	-34.84
90	FLT115-3PH	0.969	Lagging	-38.35	0.982	Lagging	-29.21	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
91	FLT116-3PH	0.968	Lagging	-38.75	0.981	Lagging	-29.40	0.995	Lagging	-15.08	0.999	Leading	6.75	0.974	Lagging	-34.97
92	FLT117-3PH	0.969	Lagging	-38.37	0.981	Lagging	-29.44	0.995	Lagging	-15.00	0.999	Leading	7.00	0.974	Lagging	-34.83
93	FLT118-3PH	0.969	Lagging	-38.37	0.982	Lagging	-29.25	0.995	Lagging	-14.88	0.999	Leading	7.00	0.974	Lagging	-34.81
94	FLT119-3PH	0.969	Lagging	-38.44	0.982	Lagging	-29.22	0.995	Lagging	-14.97	0.999	Leading	6.75	0.974	Lagging	-34.84
95	FLT120-3PH	0.969	Lagging	-38.29	0.982	Lagging	-29.05	0.995	Lagging	-14.70	0.999	Leading	7.19	0.974	Lagging	-34.79
96	FLT121-3PH	0.969	Lagging	-38.40	0.982	Lagging	-29.27	0.995	Lagging	-14.93	0.999	Leading	6.97	0.974	Lagging	-34.83
97	FLT126-3PH	0.969	Lagging	-38.33	0.981	Lagging	-29.77	0.995	Lagging	-15.40	0.999	Leading	6.59	0.974	Lagging	-34.99
98	FLT127-3PH	0.969	Lagging	-38.48	0.982	Lagging	-29.09	0.995	Lagging	-14.90	0.999	Leading	7.01	0.974	Lagging	-34.82
99	FLT128-3PH	0.969	Lagging	-38.12	0.982	Lagging	-29.21	0.995	Lagging	-15.07	0.999	Leading	6.79	0.974	Lagging	-34.98
100	FLT129-3PH	0.969	Lagging	-38.41	0.982	Lagging	-29.28	0.995	Lagging	-14.93	0.999	Leading	6.99	0.974	Lagging	-34.83

Study Generator GEN-2015-031

The Power Factor Analysis shows that GEN-2015-031 has a power factor range of 0.975 leading (absorbing) to 0.834 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.999 leading (absorbing) to 0.853 lagging (supplying) for the 2017 Summer Peak conditions, a power factor range of 0.980 leading (absorbing) to 0.956 lagging (supplying) for the 2020 Summer Peak conditions, a power factor range of 0.999 leading (absorbing) to 0.966 lagging (supplying) for the 2020 Winter Peak conditions, and a power factor range of 0.987 leading (absorbing) to 0.942 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-3
Power Factor Analysis: GEN-2015-056

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
1	FLT01-3PH	1.000	Leading	2.59	1.000	Leading	0.70	0.999	Leading	4.17	0.999	Leading	4.22	1.000	Leading	2.96
2	FLT02-3PH	1.000	Leading	2.57	1.000	Leading	0.69	0.999	Leading	4.17	0.999	Leading	4.21	1.000	Leading	2.95
3	FLT03-3PH	1.000	Leading	2.66	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.25	1.000	Leading	3.00
4	FLT04-3PH	1.000	Lagging	-2.59	0.999	Lagging	-3.28	1.000	Leading	1.75	1.000	Leading	1.76	1.000	Lagging	-3.07
5	FLT05-3PH	1.000	Lagging	-0.13	1.000	Lagging	-1.00	1.000	Leading	3.12	1.000	Leading	2.99	1.000	Leading	0.80
6	FLT06-3PH	1.000	Leading	2.59	1.000	Leading	0.71	0.999	Leading	4.18	0.999	Leading	4.22	1.000	Leading	2.97
7	FLT07-3PH	1.000	Leading	2.59	1.000	Leading	0.70	0.999	Leading	4.17	0.999	Leading	4.21	1.000	Leading	2.96
8	FLT11-3PH	1.000	Leading	2.69	1.000	Leading	0.83	0.999	Leading	4.23	0.999	Leading	4.25	1.000	Leading	3.07
9	FLT13-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
10	FLT14-3PH	1.000	Leading	2.65	1.000	Leading	0.70	0.999	Leading	4.17	0.999	Leading	4.23	1.000	Leading	2.93
11	FLT15-3PH	1.000	Leading	2.74	1.000	Leading	0.89	0.999	Leading	4.24	0.999	Leading	4.26	1.000	Leading	3.08
12	FLT16-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.02
13	FLT17-3PH	1.000	Leading	2.66	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
14	FLT18-3PH	1.000	Leading	2.66	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
15	FLT19-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
16	FLT20-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
17	FLT21-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.02
18	FLT22-3PH	1.000	Leading	2.67	1.000	Leading	0.80	0.999	Leading	4.21	0.999	Leading	4.25	1.000	Leading	3.04
19	FLT23-3PH	1.000	Leading	2.67	1.000	Leading	0.79	0.999	Leading	4.21	0.999	Leading	4.24	1.000	Leading	3.03
20	FLT24-3PH	1.000	Leading	2.65	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
21	FLT25-3PH	1.000	Leading	2.69	1.000	Leading	0.81	0.999	Leading	4.22	0.999	Leading	4.26	1.000	Leading	3.06
22	FLT26-3PH	1.000	Leading	2.65	1.000	Leading	0.76	0.999	Leading	4.19	0.999	Leading	4.23	1.000	Leading	2.99
23	FLT27-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
24	FLT28-3PH	1.000	Leading	2.66	1.000	Leading	0.81	0.999	Leading	4.22	0.999	Leading	4.24	1.000	Leading	3.07
25	FLT29-3PH	0.999	Leading	4.04	1.000	Leading	2.29	0.999	Leading	5.31	0.999	Leading	5.14	0.999	Leading	4.36
26	FLT30-3PH	1.000	Leading	2.82	1.000	Leading	0.82	0.999	Leading	4.25	0.999	Leading	4.35	1.000	Leading	2.94
27	FLT31-3PH	1.000	Leading	2.66	1.000	Leading	0.79	0.999	Leading	4.21	0.999	Leading	4.24	1.000	Leading	3.03
28	FLT34-3PH	1.000	Leading	2.66	1.000	Leading	0.79	0.999	Leading	4.21	0.999	Leading	4.25	1.000	Leading	3.02
29	FLT35-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.19	0.999	Leading	4.24	1.000	Leading	3.00
30	FLT36-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.23	1.000	Leading	3.01
31	FLT37-3PH	1.000	Leading	2.52	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.13	1.000	Leading	2.96
32	FLT38-3PH	1.000	Leading	2.57	1.000	Leading	0.74	0.999	Leading	4.15	0.999	Leading	4.15	1.000	Leading	2.97
33	FLT39-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.02
34	FLT40-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
35	FLT41-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
36	FLT43-3PH	1.000	Leading	2.90	1.000	Leading	1.06	0.999	Leading	4.56	0.999	Leading	4.65	0.999	Leading	3.51
37	FLT45-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
38	FLT46-3PH	1.000	Leading	2.68	1.000	Leading	0.78	0.999	Leading	4.13	0.999	Leading	4.15	1.000	Leading	2.91
39	FLT47-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
40	FLT48-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
41	FLT49-3PH	1.000	Leading	2.89	1.000	Leading	1.06	0.999	Leading	4.55	0.999	Leading	4.64	0.999	Leading	3.51
42	FLT52-3PH	1.000	Leading	2.39	1.000	Leading	0.49	0.999	Leading	3.78	0.999	Leading	3.92	1.000	Leading	2.42
43	FLT54-3PH	1.000	Leading	2.50	1.000	Leading	0.67	0.999	Leading	4.01	0.999	Leading	3.97	1.000	Leading	2.81
44	FLT55-3PH	1.000	Leading	2.65	1.000	Leading	0.76	0.999	Leading	4.19	0.999	Leading	4.24	1.000	Leading	2.99
45	FLT56-3PH	1.000	Leading	2.35	1.000	Leading	0.47	0.999	Leading	3.88	0.999	Leading	4.00	1.000	Leading	2.48
46	FLT57-3PH	1.000	Leading	2.35	1.000	Leading	0.49	0.999	Leading	3.76	0.999	Leading	3.86	1.000	Leading	2.46
47	FLT58-3PH	1.000	Leading	2.33	1.000	Leading	0.45	0.999	Leading	3.85	0.999	Leading	3.98	1.000	Leading	2.44
48	FLT59-3PH	1.000	Leading	0.76	1.000	Lagging	-0.65	1.000	Leading	2.94	1.000	Leading	3.15	1.000	Leading	0.42
49	FLT60-3PH	1.000	Leading	2.63	1.000	Leading	0.66	0.999	Leading	4.07	0.999	Leading	4.21	1.000	Leading	2.95
50	FLT63-3PH	1.000	Leading	2.61	1.000	Leading	0.75	0.999	Leading	4.19	0.999	Leading	4.24	1.000	Leading	2.98
51	FLT64-3PH	1.000	Leading	2.54	1.000	Leading	0.67	0.999	Leading	4.16	0.999	Leading	4.21	1.000	Leading	2.90
52	FLT65-3PH	1.000	Leading	2.60	1.000	Leading	0.73	0.999	Leading	4.19	0.999	Leading	4.23	1.000	Leading	2.97
53	FLT66-3PH	1.000	Leading	2.23	1.000	Leading	0.43	0.999	Leading	4.06	0.999	Leading	4.11	1.000	Leading	2.75
54	FLT67-3PH	1.000	Leading	2.58	1.000	Leading	0.70	0.999	Leading	4.15	0.999	Leading	4.21	1.000	Leading	2.93
55	FLT68-3PH	1.000	Leading	2.59	1.000	Leading	0.72	0.999	Leading	4.18	0.999	Leading	4.23	1.000	Leading	2.96
56	FLT69-3PH	1.000	Lagging	-0.19	1.000	Lagging	-1.40	1.000	Leading	2.66	1.000	Leading	2.89	1.000	Lagging	-0.55
57	FLT70-3PH	1.000	Leading	2.67	1.000	Leading	0.78	0.999	Leading	4.21	0.999	Leading	4.25	1.000	Leading	3.04
58	FLT71-3PH	1.000	Leading	2.62	1.000	Leading	0.74	0.999	Leading	4.18	0.999	Leading	4.22	1.000	Leading	2.98
59	FLT72-3PH	1.000	Leading	2.71	1.000	Leading	0.89	0.999	Leading	4.27	0.999	Leading	4.27	1.000	Leading	3.12
60	FLT73-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
61	FLT74-3PH	1.000	Leading	2.65	1.000	Leading	0.79	0.999	Leading	4.21	0.999	Leading	4.24	1.000	Leading	3.02
62	FLT75-3PH	1.000	Leading	2.85	1.000	Leading	1.22	0.999	Leading	4.48	0.999	Leading	4.43	1.000	Leading	3.06
63	FLT76-3PH	1.000	Leading	2.58	1.000	Leading	0.72	0.999	Leading	4.18	0.999	Leading	4.22	1.000	Leading	2.95
64	FLT77-3PH	0.999	Leading	4.45	1.000	Leading	2.65	0.999	Leading	5.02	0.999	Leading	4.87	0.999	Leading	4.37
65	FLT84-3PH	1.000	Leading	2.70	1.000	Leading	0.79	0.999	Leading	4.31	0.999	Leading	4.36	1.000	Leading	3.15
66	FLT85-3PH	1.000	Leading	2.58	1.000	Leading	0.62	0.999	Leading	4.15	0.999	Leading	4.21	1.000	Leading	2.88
67	FLT86-3PH	1.000	Leading	1.52	1.000	Leading	0.09	0.999	Leading	3.20	1.000	Leading	3.13	1.000	Leading	1.62
68	FLT87-3PH	1.000	Leading	2.75	1.000	Leading	0.76	0.999	Leading	4.18	0.999	Leading	4.22	1.000	Leading	2.96
69	FLT88-3PH	1.000	Leading	2.65	1.000	Leading	0.75	0.999	Leading	4.21	0.999	Leading	4.24	1.000	Leading	3.04
70	FLT92-3PH	0.970	Lagging	-25.16	0.983	Lagging	-19.08	0.995	Lagging	-9.93	0.978	Lagging	-21.76	0.997	Lagging	-7.19

Table 5-3 (continued)
Power Factor Analysis: GEN-2015-056

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	1.000	Lagging	-2.86	0.993	Lagging	-11.61	0.988	Lagging	-16.05	0.999	Lagging	-4.83	0.986	Lagging	-16.87
72	FLT94-3PH	0.974	Lagging	-23.67	0.985	Lagging	-17.60	0.997	Lagging	-8.43	0.980	Lagging	-20.25	0.998	Lagging	-5.70
73	FLT95-3PH	0.994	Leading	11.28	1.000	Leading	2.49	1.000	Lagging	-1.68	0.996	Leading	9.51	1.000	Lagging	-2.65
74	FLT96-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.21	0.999	Leading	4.25	1.000	Leading	3.04
75	FLT97-3PH	1.000	Leading	2.69	1.000	Leading	0.81	0.999	Leading	4.22	0.999	Leading	4.26	1.000	Leading	3.08
76	FLT98-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.19	0.999	Leading	4.23	1.000	Leading	3.00
77	FLT99-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.22	0.999	Leading	4.25	1.000	Leading	3.05
78	FLT100-3PH	1.000	Leading	2.69	1.000	Leading	0.81	0.999	Leading	4.22	0.999	Leading	4.26	1.000	Leading	3.08
79	FLT101-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.03
80	FLT102-3PH	1.000	Leading	2.69	1.000	Leading	0.81	0.999	Leading	4.26	0.999	Leading	4.29	1.000	Leading	3.14
81	FLT105-3PH	1.000	Leading	2.63	1.000	Leading	0.67	0.999	Leading	4.15	0.999	Leading	4.21	1.000	Leading	2.87
82	FLT106-3PH	1.000	Leading	2.64	1.000	Leading	0.74	0.999	Leading	4.18	0.999	Leading	4.23	1.000	Leading	2.98
83	FLT107-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
84	FLT108-3PH	1.000	Leading	2.66	1.000	Leading	0.78	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.03
85	FLT109-3PH	1.000	Leading	2.63	1.000	Leading	0.76	0.999	Leading	4.19	0.999	Leading	4.23	1.000	Leading	2.99
86	FLT111-3PH	1.000	Leading	2.65	1.000	Leading	0.80	0.999	Leading	4.21	0.999	Leading	4.24	1.000	Leading	3.02
87	FLT112-3PH	1.000	Leading	2.62	1.000	Leading	0.84	0.999	Leading	4.24	0.999	Leading	4.25	1.000	Leading	3.02
88	FLT113-3PH	1.000	Leading	2.58	1.000	Leading	0.71	0.999	Leading	4.16	0.999	Leading	4.21	1.000	Leading	2.90
89	FLT114-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
90	FLT115-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
91	FLT116-3PH	1.000	Leading	2.46	1.000	Leading	0.64	0.999	Leading	4.12	0.999	Leading	4.16	1.000	Leading	2.81
92	FLT117-3PH	1.000	Leading	2.71	1.000	Leading	0.88	0.999	Leading	4.26	0.999	Leading	4.28	1.000	Leading	3.11
93	FLT118-3PH	1.000	Leading	2.64	1.000	Leading	0.76	0.999	Leading	4.19	0.999	Leading	4.23	1.000	Leading	3.01
94	FLT119-3PH	1.000	Leading	2.61	1.000	Leading	0.72	0.999	Leading	4.16	0.999	Leading	4.21	1.000	Leading	2.94
95	FLT120-3PH	1.000	Leading	2.38	1.000	Leading	0.53	0.999	Leading	4.06	0.999	Leading	4.07	1.000	Leading	2.68
96	FLT121-3PH	1.000	Leading	2.65	1.000	Leading	0.77	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
97	FLT126-3PH	1.000	Leading	0.63	1.000	Lagging	-0.20	0.999	Leading	3.89	0.999	Leading	3.77	1.000	Leading	2.00
98	FLT127-3PH	1.000	Leading	2.67	1.000	Leading	0.75	0.999	Leading	4.20	0.999	Leading	4.24	1.000	Leading	3.01
99	FLT128-3PH	1.000	Leading	1.77	1.000	Leading	0.80	0.999	Leading	4.70	0.999	Leading	4.61	0.999	Leading	4.08
100	FLT129-3PH	1.000	Leading	2.72	1.000	Leading	0.85	0.999	Leading	4.23	0.999	Leading	4.27	1.000	Leading	3.09

Study Generator GEN-2015-056

The Power Factor Analysis shows that GEN-2015-056 has a power factor range of 0.999 leading (absorbing) to 0.970 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.983 lagging (supplying) to 1.00 (unity) for the 2017 Summer Peak conditions, a power factor range of 0.999 leading (absorbing) to 0.988 lagging (supplying) for the 2020 Summer Peak conditions, a power factor range of 0.999 leading (absorbing) to 0.978 lagging (supplying) for the 2020 Winter Peak conditions, and a power factor range of 0.999 leading (absorbing) to 0.986 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-4
Power Factor Analysis: GEN-2015-058

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
1	FLT01-3PH	0.997	Leading	3.70	0.994	Leading	5.34	0.990	Leading	7.17	0.998	Leading	2.89	0.990	Leading	7.09
2	FLT02-3PH	0.998	Leading	3.40	0.995	Leading	4.96	0.990	Leading	6.95	0.999	Leading	2.70	0.991	Leading	6.81
3	FLT03-3PH	0.997	Leading	4.03	0.994	Leading	5.55	0.991	Leading	6.65	0.999	Leading	2.30	0.989	Leading	7.52
4	FLT04-3PH	0.991	Leading	6.91	0.989	Leading	7.39	0.985	Leading	8.68	0.996	Leading	4.35	0.981	Leading	9.81
5	FLT05-3PH	1.000	Lagging	-1.48	0.998	Leading	3.23	0.997	Leading	3.71	0.999	Lagging	-1.86	0.996	Leading	4.23
6	FLT06-3PH	0.997	Leading	3.92	0.994	Leading	5.68	0.989	Leading	7.40	0.998	Leading	3.05	0.989	Leading	7.35
7	FLT07-3PH	0.997	Leading	3.66	0.994	Leading	5.27	0.990	Leading	7.13	0.998	Leading	2.86	0.990	Leading	7.06
8	FLT11-3PH	0.996	Leading	4.30	0.994	Leading	5.66	0.989	Leading	7.38	0.998	Leading	3.05	0.989	Leading	7.42
9	FLT13-3PH	0.996	Leading	4.33	0.994	Leading	5.64	0.989	Leading	7.39	0.998	Leading	3.10	0.989	Leading	7.40
10	FLT14-3PH	0.996	Leading	4.31	0.994	Leading	5.53	0.989	Leading	7.39	0.998	Leading	3.08	0.989	Leading	7.40
11	FLT15-3PH	0.997	Leading	4.14	0.994	Leading	5.50	0.990	Leading	7.19	0.998	Leading	2.88	0.990	Leading	7.21
12	FLT16-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.40
13	FLT17-3PH	0.996	Leading	4.30	0.994	Leading	5.62	0.989	Leading	7.38	0.998	Leading	3.07	0.989	Leading	7.39
14	FLT18-3PH	0.996	Leading	4.30	0.994	Leading	5.62	0.989	Leading	7.38	0.998	Leading	3.07	0.989	Leading	7.39
15	FLT19-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
16	FLT20-3PH	0.996	Leading	4.33	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
17	FLT21-3PH	0.996	Leading	4.32	0.994	Leading	5.63	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.40
18	FLT22-3PH	0.996	Leading	4.30	0.994	Leading	5.62	0.989	Leading	7.38	0.998	Leading	3.07	0.989	Leading	7.38
19	FLT23-3PH	0.996	Leading	4.31	0.994	Leading	5.63	0.989	Leading	7.39	0.998	Leading	3.08	0.989	Leading	7.39
20	FLT24-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.41
21	FLT25-3PH	0.996	Leading	4.27	0.994	Leading	5.58	0.989	Leading	7.34	0.998	Leading	3.04	0.989	Leading	7.33
22	FLT26-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.39	0.998	Leading	3.10	0.989	Leading	7.40
23	FLT27-3PH	0.996	Leading	4.32	0.994	Leading	5.63	0.989	Leading	7.39	0.998	Leading	3.09	0.989	Leading	7.39
24	FLT28-3PH	0.996	Leading	4.47	0.994	Leading	5.64	0.989	Leading	7.38	0.998	Leading	3.22	0.989	Leading	7.40
25	FLT29-3PH	0.999	Leading	2.62	0.997	Leading	3.63	0.995	Leading	5.03	1.000	Leading	1.04	0.992	Leading	6.18
26	FLT30-3PH	0.997	Leading	4.04	0.994	Leading	5.66	0.989	Leading	7.39	0.998	Leading	2.80	0.989	Leading	7.53
27	FLT31-3PH	0.996	Leading	4.24	0.994	Leading	5.58	0.989	Leading	7.33	0.998	Leading	3.00	0.989	Leading	7.36
28	FLT34-3PH	0.996	Leading	4.34	0.994	Leading	5.66	0.989	Leading	7.39	0.998	Leading	3.08	0.989	Leading	7.41
29	FLT35-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.39	0.998	Leading	3.09	0.989	Leading	7.40
30	FLT36-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.41
31	FLT37-3PH	0.996	Leading	4.27	0.994	Leading	5.65	0.989	Leading	7.41	0.998	Leading	3.04	0.989	Leading	7.39
32	FLT38-3PH	0.996	Leading	4.30	0.994	Leading	5.64	0.989	Leading	7.39	0.998	Leading	3.06	0.989	Leading	7.40
33	FLT39-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.41
34	FLT40-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
35	FLT41-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
36	FLT43-3PH	0.996	Leading	4.44	0.993	Leading	5.76	0.989	Leading	7.43	0.998	Leading	3.18	0.989	Leading	7.48
37	FLT45-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
38	FLT46-3PH	0.996	Leading	4.34	0.994	Leading	5.65	0.989	Leading	7.37	0.998	Leading	3.05	0.989	Leading	7.40
39	FLT47-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
40	FLT48-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
41	FLT49-3PH	0.996	Leading	4.44	0.993	Leading	5.76	0.989	Leading	7.48	0.998	Leading	3.23	0.989	Leading	7.52
42	FLT52-3PH	0.996	Leading	4.32	0.994	Leading	5.62	0.990	Leading	7.27	0.998	Leading	2.99	0.989	Leading	7.31
43	FLT54-3PH	0.996	Leading	4.21	0.994	Leading	5.57	0.990	Leading	7.28	0.998	Leading	2.89	0.989	Leading	7.31
44	FLT55-3PH	0.996	Leading	4.31	0.994	Leading	5.63	0.989	Leading	7.38	0.998	Leading	3.08	0.989	Leading	7.39
45	FLT56-3PH	0.996	Leading	4.26	0.994	Leading	5.59	0.989	Leading	7.33	0.998	Leading	3.03	0.989	Leading	7.32
46	FLT57-3PH	0.996	Leading	4.27	0.994	Leading	5.60	0.990	Leading	7.26	0.998	Leading	2.94	0.990	Leading	7.30
47	FLT58-3PH	0.996	Leading	4.26	0.994	Leading	5.59	0.989	Leading	7.32	0.998	Leading	3.02	0.989	Leading	7.31
48	FLT59-3PH	0.997	Leading	3.69	0.995	Leading	5.25	0.990	Leading	6.97	0.999	Leading	2.61	0.991	Leading	6.75
49	FLT60-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.39	0.998	Leading	3.10	0.989	Leading	7.40
50	FLT63-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
51	FLT64-3PH	0.996	Leading	4.29	0.994	Leading	5.62	0.989	Leading	7.38	0.998	Leading	3.08	0.989	Leading	7.35
52	FLT65-3PH	0.996	Leading	4.31	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
53	FLT66-3PH	0.997	Leading	4.18	0.994	Leading	5.56	0.989	Leading	7.46	0.998	Leading	3.13	0.989	Leading	7.41
54	FLT67-3PH	0.996	Leading	4.30	0.994	Leading	5.63	0.989	Leading	7.39	0.998	Leading	3.10	0.989	Leading	7.39
55	FLT68-3PH	0.996	Leading	4.31	0.994	Leading	5.64	0.989	Leading	7.41	0.998	Leading	3.11	0.989	Leading	7.40
56	FLT69-3PH	0.998	Leading	3.39	0.995	Leading	5.05	0.990	Leading	6.95	0.999	Leading	2.56	0.991	Leading	6.61
57	FLT70-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.41	0.998	Leading	3.12	0.989	Leading	7.42
58	FLT71-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.40
59	FLT72-3PH	0.996	Leading	4.35	0.994	Leading	5.68	0.989	Leading	7.39	0.998	Leading	3.10	0.989	Leading	7.41
60	FLT73-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
61	FLT74-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.39	0.998	Leading	3.09	0.989	Leading	7.40
62	FLT75-3PH	0.996	Leading	4.40	0.993	Leading	5.78	0.989	Leading	7.54	0.998	Leading	3.21	0.989	Leading	7.49
63	FLT76-3PH	0.996	Leading	4.30	0.994	Leading	5.63	0.989	Leading	7.41	0.998	Leading	3.11	0.989	Leading	7.40
64	FLT77-3PH	0.995	Leading	5.05	0.992	Leading	6.32	0.989	Leading	7.44	0.998	Leading	3.24	0.989	Leading	7.48
65	FLT84-3PH	0.996	Leading	4.35	0.994	Leading	5.65	0.989	Leading	7.45	0.998	Leading	3.17	0.989	Leading	7.44
66	FLT85-3PH	0.996	Leading	4.30	0.994	Leading	5.60	0.989	Leading	7.39	0.998	Leading	3.09	0.989	Leading	7.36
67	FLT86-3PH	0.997	Leading	4.01	0.994	Leading	5.48	0.990	Leading	7.12	0.999	Leading	2.65	0.990	Leading	7.13
68	FLT87-3PH	0.996	Leading	4.36	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.39
69	FLT88-3PH	0.996	Leading	4.33	0.994	Leading	5.64	0.989	Leading	7.41	0.998	Leading	3.10	0.989	Leading	7.41
70	FLT92-3PH	0.996	Leading	4.73	0.993	Leading	6.13	0.989	Leading	7.60	0.998	Leading	3.11	0.990	Leading	7.28

Table 5-4 (continued)
Power Factor Analysis: GEN-2015-058

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	0.999	Leading	1.75	0.999	Leading	2.67	0.995	Leading	4.91	1.000	Leading	0.94	0.996	Leading	4.48
72	FLT94-3PH	0.996	Leading	4.73	0.993	Leading	6.13	0.989	Leading	7.60	0.998	Leading	3.11	0.989	Leading	7.59
73	FLT95-3PH	0.999	Leading	1.75	0.999	Leading	2.67	0.995	Leading	4.91	1.000	Leading	0.94	0.996	Leading	4.48
74	FLT96-3PH	0.971	Leading	12.26	0.980	Leading	10.18	0.993	Leading	5.83	0.997	Leading	3.55	0.991	Leading	6.76
75	FLT97-3PH	0.946	Lagging	-17.16	0.954	Lagging	-15.75	0.995	Lagging	-4.82	0.995	Lagging	-4.83	0.975	Lagging	-11.30
76	FLT98-3PH	0.973	Leading	11.85	0.975	Leading	11.44	0.976	Leading	11.25	0.990	Leading	7.03	0.972	Leading	11.99
77	FLT99-3PH	0.982	Leading	9.63	0.989	Leading	7.43	0.999	Leading	2.66	1.000	Leading	0.43	0.998	Leading	3.53
78	FLT100-3PH	0.940	Lagging	-18.17	0.947	Lagging	-16.91	0.990	Lagging	-7.13	0.992	Lagging	-6.17	0.969	Lagging	-12.67
79	FLT101-3PH	1.000	Leading	0.56	0.999	Leading	1.95	0.996	Leading	4.21	1.000	Leading	0.54	1.000	Leading	1.53
80	FLT102-3PH	1.000	Leading	0.93	1.000	Lagging	-0.76	0.996	Lagging	-4.57	0.993	Lagging	-5.89	0.995	Lagging	-4.98
81	FLT105-3PH	0.996	Leading	4.32	0.994	Leading	5.62	0.989	Leading	7.38	0.998	Leading	3.08	0.989	Leading	7.35
82	FLT106-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.39	0.998	Leading	3.09	0.989	Leading	7.39
83	FLT107-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.41
84	FLT108-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.41	0.998	Leading	3.10	0.989	Leading	7.42
85	FLT109-3PH	0.996	Leading	4.32	0.994	Leading	5.64	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.40
86	FLT111-3PH	0.996	Leading	4.33	0.994	Leading	5.66	0.989	Leading	7.40	0.998	Leading	3.09	0.989	Leading	7.41
87	FLT112-3PH	0.996	Leading	4.31	0.994	Leading	5.67	0.989	Leading	7.41	0.998	Leading	3.10	0.989	Leading	7.40
88	FLT113-3PH	0.996	Leading	4.30	0.994	Leading	5.63	0.989	Leading	7.38	0.998	Leading	3.08	0.989	Leading	7.37
89	FLT114-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
90	FLT115-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
91	FLT116-3PH	0.996	Leading	4.26	0.994	Leading	5.61	0.989	Leading	7.38	0.998	Leading	3.07	0.989	Leading	7.36
92	FLT117-3PH	0.996	Leading	4.35	0.994	Leading	5.68	0.989	Leading	7.41	0.998	Leading	3.11	0.989	Leading	7.43
93	FLT118-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.41	0.998	Leading	3.10	0.989	Leading	7.42
94	FLT119-3PH	0.996	Leading	4.31	0.994	Leading	5.63	0.989	Leading	7.35	0.998	Leading	3.07	0.989	Leading	7.36
95	FLT120-3PH	0.996	Leading	4.23	0.994	Leading	5.59	0.989	Leading	7.44	0.998	Leading	3.11	0.989	Leading	7.39
96	FLT121-3PH	0.996	Leading	4.33	0.994	Leading	5.65	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
97	FLT126-3PH	0.997	Leading	3.63	0.994	Leading	5.35	0.990	Leading	7.26	0.998	Leading	2.87	0.990	Leading	7.09
98	FLT127-3PH	0.997	Leading	4.05	0.995	Leading	5.24	0.989	Leading	7.40	0.998	Leading	3.10	0.989	Leading	7.40
99	FLT128-3PH	0.998	Leading	2.95	0.994	Leading	5.66	0.990	Leading	7.24	0.998	Leading	3.00	0.990	Leading	7.19
100	FLT129-3PH	0.996	Leading	4.37	0.994	Leading	5.71	0.989	Leading	7.46	0.998	Leading	3.16	0.989	Leading	7.46

Study Generator GEN-2015-058

The Power Factor Analysis shows that GEN-2015-058 has a power factor range of 0.971 leading (absorbing) to 0.940 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.975 leading (absorbing) to 0.947 lagging (supplying) for the 2017 Summer Peak conditions, a power factor range of 0.976 leading (absorbing) to 0.999 lagging (supplying) for the 2020 Summer Peak conditions, a power factor range of 0.990 leading (absorbing) to 0.992 lagging (supplying) for the 2020 Winter Peak conditions, and a power factor range of 0.972 leading (absorbing) to 0.969 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-5
Power Factor Analysis: GEN-2015-068

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
1	FLT01-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.34	0.998	Lagging	-16.81	0.992	Lagging	-37.17	0.999	Lagging	-15.94
2	FLT02-3PH	0.871	Lagging	-169.04	0.976	Lagging	-66.39	0.998	Lagging	-16.80	0.992	Lagging	-37.16	0.999	Lagging	-15.95
3	FLT03-3PH	0.871	Lagging	-169.11	0.976	Lagging	-66.41	0.998	Lagging	-17.04	0.992	Lagging	-37.40	0.999	Lagging	-15.94
4	FLT04-3PH	0.873	Lagging	-167.44	0.977	Lagging	-65.40	0.999	Lagging	-15.91	0.993	Lagging	-36.21	0.999	Lagging	-15.69
5	FLT05-3PH	0.873	Lagging	-167.54	0.977	Lagging	-65.14	0.998	Lagging	-16.51	0.993	Lagging	-36.44	0.999	Lagging	-15.70
6	FLT06-3PH	0.871	Lagging	-168.97	0.976	Lagging	-66.30	0.998	Lagging	-16.78	0.992	Lagging	-37.15	0.999	Lagging	-15.92
7	FLT07-3PH	0.871	Lagging	-169.02	0.976	Lagging	-66.35	0.998	Lagging	-16.81	0.992	Lagging	-37.17	0.999	Lagging	-15.93
8	FLT11-3PH	0.871	Lagging	-168.92	0.977	Lagging	-66.00	0.998	Lagging	-16.71	0.992	Lagging	-37.17	0.999	Lagging	-15.79
9	FLT13-3PH	0.871	Lagging	-169.04	0.976	Lagging	-66.62	0.998	Lagging	-16.93	0.992	Lagging	-37.22	0.999	Lagging	-15.99
10	FLT14-3PH	0.871	Lagging	-169.14	0.976	Lagging	-67.08	0.998	Lagging	-17.04	0.992	Lagging	-37.42	0.999	Lagging	-15.99
11	FLT15-3PH	0.868	Lagging	-171.68	0.974	Lagging	-70.03	0.998	Lagging	-19.73	0.991	Lagging	-39.62	0.998	Lagging	-17.07
12	FLT16-3PH	0.871	Lagging	-169.07	0.976	Lagging	-66.47	0.998	Lagging	-16.87	0.992	Lagging	-37.26	0.999	Lagging	-15.95
13	FLT17-3PH	0.871	Lagging	-169.10	0.976	Lagging	-66.45	0.998	Lagging	-16.82	0.992	Lagging	-37.28	0.999	Lagging	-15.94
14	FLT18-3PH	0.871	Lagging	-169.10	0.976	Lagging	-66.46	0.998	Lagging	-16.82	0.992	Lagging	-37.28	0.999	Lagging	-15.94
15	FLT19-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
16	FLT20-3PH	0.871	Lagging	-169.00	0.976	Lagging	-66.37	0.998	Lagging	-16.78	0.992	Lagging	-37.19	0.999	Lagging	-15.92
17	FLT21-3PH	0.871	Lagging	-169.23	0.976	Lagging	-66.72	0.998	Lagging	-17.07	0.992	Lagging	-37.43	0.999	Lagging	-16.08
18	FLT22-3PH	0.871	Lagging	-169.19	0.976	Lagging	-66.69	0.998	Lagging	-17.05	0.992	Lagging	-37.39	0.999	Lagging	-16.06
19	FLT23-3PH	0.871	Lagging	-169.13	0.976	Lagging	-66.58	0.998	Lagging	-16.97	0.992	Lagging	-37.32	0.999	Lagging	-16.00
20	FLT24-3PH	0.871	Lagging	-169.19	0.976	Lagging	-66.64	0.998	Lagging	-17.00	0.992	Lagging	-37.38	0.999	Lagging	-16.04
21	FLT25-3PH	0.871	Lagging	-169.10	0.976	Lagging	-66.49	0.998	Lagging	-16.77	0.992	Lagging	-37.23	0.999	Lagging	-15.96
22	FLT26-3PH	0.871	Lagging	-169.12	0.976	Lagging	-66.42	0.998	Lagging	-16.78	0.992	Lagging	-37.21	0.999	Lagging	-15.95
23	FLT27-3PH	0.871	Lagging	-169.09	0.976	Lagging	-66.39	0.998	Lagging	-16.79	0.992	Lagging	-37.17	0.999	Lagging	-15.93
24	FLT28-3PH	0.871	Lagging	-169.39	0.976	Lagging	-66.61	0.998	Lagging	-17.01	0.992	Lagging	-37.57	0.999	Lagging	-16.05
25	FLT29-3PH	0.871	Lagging	-168.70	0.976	Lagging	-66.64	0.998	Lagging	-16.97	0.992	Lagging	-37.21	0.999	Lagging	-16.07
26	FLT30-3PH	0.871	Lagging	-169.02	0.976	Lagging	-66.30	0.998	Lagging	-16.74	0.992	Lagging	-37.22	0.999	Lagging	-15.91
27	FLT31-3PH	0.871	Lagging	-169.15	0.976	Lagging	-66.58	0.998	Lagging	-16.95	0.992	Lagging	-37.33	0.999	Lagging	-16.01
28	FLT34-3PH	0.843	Lagging	-191.76	0.961	Lagging	-86.81	0.994	Lagging	-32.30	0.981	Lagging	-58.74	0.997	Lagging	-21.85
29	FLT35-3PH	0.862	Lagging	-176.81	0.971	Lagging	-74.27	0.997	Lagging	-22.29	0.990	Lagging	-43.42	0.999	Lagging	-15.37
30	FLT36-3PH	0.872	Lagging	-168.40	0.978	Lagging	-63.24	0.999	Lagging	-13.95	0.993	Lagging	-36.31	0.999	Lagging	-14.17
31	FLT37-3PH	0.882	Lagging	-160.16	0.977	Lagging	-65.53	0.999	Lagging	-11.59	0.991	Lagging	-40.46	0.999	Lagging	-13.87
32	FLT38-3PH	0.877	Lagging	-163.98	0.979	Lagging	-62.70	0.999	Lagging	-11.36	0.994	Lagging	-32.65	0.999	Lagging	-15.10
33	FLT39-3PH	0.871	Lagging	-169.08	0.976	Lagging	-66.59	0.998	Lagging	-17.00	0.992	Lagging	-37.44	0.999	Lagging	-16.13
34	FLT40-3PH	0.872	Lagging	-168.65	0.976	Lagging	-66.96	0.998	Lagging	-17.05	0.992	Lagging	-37.49	0.999	Lagging	-15.99
35	FLT41-3PH	0.871	Lagging	-169.36	0.976	Lagging	-67.24	0.998	Lagging	-17.47	0.992	Lagging	-38.07	0.999	Lagging	-16.02
36	FLT43-3PH	0.737	Lagging	-275.02	0.889	Lagging	-154.77	0.960	Lagging	-87.50	0.914	Lagging	-132.80	0.976	Lagging	-66.89
37	FLT45-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
38	FLT46-3PH	0.878	Lagging	-163.69	0.975	Lagging	-67.99	0.998	Lagging	-20.59	0.990	Lagging	-43.71	1.000	Lagging	-3.45
39	FLT47-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
40	FLT48-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
41	FLT49-3PH	0.791	Lagging	-232.42	0.937	Lagging	-111.69	0.989	Lagging	-43.83	0.958	Lagging	-90.17	0.997	Lagging	-23.05
42	FLT52-3PH	0.845	Lagging	-189.81	0.958	Lagging	-90.21	0.992	Lagging	-37.22	0.982	Lagging	-57.50	0.997	Lagging	-23.31
43	FLT54-3PH	0.835	Lagging	-197.48	0.961	Lagging	-86.30	0.995	Lagging	-30.96	0.979	Lagging	-63.04	0.998	Lagging	-19.76
44	FLT55-3PH	0.871	Lagging	-169.44	0.976	Lagging	-66.68	0.998	Lagging	-17.36	0.992	Lagging	-37.52	0.999	Lagging	-16.18
45	FLT56-3PH	0.868	Lagging	-171.58	0.974	Lagging	-69.74	0.998	Lagging	-19.57	0.991	Lagging	-39.46	0.998	Lagging	-16.74
46	FLT57-3PH	0.855	Lagging	-181.95	0.967	Lagging	-78.69	0.995	Lagging	-29.12	0.987	Lagging	-48.17	0.998	Lagging	-18.89
47	FLT58-3PH	0.868	Lagging	-171.79	0.974	Lagging	-70.00	0.998	Lagging	-19.79	0.991	Lagging	-39.64	0.998	Lagging	-16.80
48	FLT59-3PH	0.871	Lagging	-168.93	0.975	Lagging	-68.01	0.998	Lagging	-19.77	0.992	Lagging	-38.67	0.999	Lagging	-15.02
49	FLT60-3PH	0.871	Lagging	-169.00	0.976	Lagging	-66.53	0.998	Lagging	-17.25	0.992	Lagging	-37.18	0.999	Lagging	-15.97
50	FLT63-3PH	0.871	Lagging	-168.98	0.976	Lagging	-66.45	0.998	Lagging	-16.86	0.992	Lagging	-37.22	0.999	Lagging	-16.02
51	FLT64-3PH	0.872	Lagging	-168.70	0.977	Lagging	-66.19	0.998	Lagging	-17.30	0.992	Lagging	-37.58	0.998	Lagging	-16.94
52	FLT65-3PH	0.871	Lagging	-169.00	0.976	Lagging	-66.46	0.998	Lagging	-16.85	0.992	Lagging	-37.27	0.999	Lagging	-15.99
53	FLT66-3PH	0.871	Lagging	-169.24	0.976	Lagging	-67.47	0.998	Lagging	-16.71	0.992	Lagging	-37.42	0.999	Lagging	-15.09
54	FLT67-3PH	0.871	Lagging	-169.39	0.976	Lagging	-66.60	0.998	Lagging	-17.08	0.992	Lagging	-37.47	0.999	Lagging	-16.16
55	FLT68-3PH	0.871	Lagging	-168.91	0.976	Lagging	-66.37	0.998	Lagging	-16.61	0.992	Lagging	-37.04	0.999	Lagging	-15.79
56	FLT69-3PH	0.872	Lagging	-168.43	0.976	Lagging	-66.84	0.998	Lagging	-17.66	0.992	Lagging	-37.18	0.999	Lagging	-16.06
57	FLT70-3PH	0.871	Lagging	-169.39	0.976	Lagging	-66.84	0.998	Lagging	-17.16	0.992	Lagging	-37.35	0.999	Lagging	-16.02
58	FLT71-3PH	0.871	Lagging	-169.44	0.976	Lagging	-66.55	0.998	Lagging	-17.07	0.992	Lagging	-37.43	0.999	Lagging	-16.08
59	FLT72-3PH	0.871	Lagging	-168.99	0.976	Lagging	-66.76	0.998	Lagging	-17.48	0.992	Lagging	-37.32	0.999	Lagging	-16.16
60	FLT73-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
61	FLT74-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.66	0.998	Lagging	-17.27	0.992	Lagging	-37.65	0.999	Lagging	-16.21
62	FLT75-3PH	0.870	Lagging	-169.71	0.976	Lagging	-67.42	0.998	Lagging	-17.18	0.992	Lagging	-37.98	0.999	Lagging	-14.14
63	FLT76-3PH	0.871	Lagging	-168.88	0.976	Lagging	-66.34	0.998	Lagging	-16.61	0.992	Lagging	-37.03	0.999	Lagging	-15.80
64	FLT77-3PH	0.871	Lagging	-169.25	0.976	Lagging	-67.60	0.998	Lagging	-19.08	0.992	Lagging	-37.98	0.998	Lagging	-19.55
65	FLT84-3PH	0.877	Lagging	-164.04	0.980	Lagging	-60.82	0.999	Lagging	-10.47	0.995	Lagging	-30.33	0.999	Lagging	-11.55
66	FLT85-3PH	0.873	Lagging	-167.39	0.981	Lagging	-58.76	0.999	Lagging	-11.86	0.995	Lagging	-30.26	0.998	Lagging	-18.07
67	FLT86-3PH	0.891	Lagging	-153.04	0.984	Lagging	-53.89	1.000	Lagging	-6.45	0.995	Lagging	-29.76	0.999	Lagging	-11.89
68	FLT87-3PH	0.873	Lagging	-167.41	0.981	Lagging	-60.00	0.999	Lagging	-16.14	0.993	Lagging	-36.45	0.998	Lagging	-16.59
69	FLT88-3PH	0.877	Lagging	-164.21	0.977	Lagging	-65.86	0.999	Lagging	-15.88	0.993	Lagging	-35.57	0.998	Lagging	-17.01
70	FLT92-3PH	0.873	Lagging	-167.42	0.977	Lagging	-65.31	0.998	Lagging	-16.51	0.993	Lagging	-36.94	0.999	Lagging	-15.59

Table 5-5 (continued)
Power Factor Analysis: GEN-2015-068

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	0.876	Lagging	-165.13	0.978	Lagging	-64.07	0.998	Lagging	-16.47	0.993	Lagging	-35.47	0.998	Lagging	-17.19
72	FLT94-3PH	0.873	Lagging	-167.45	0.977	Lagging	-65.34	0.998	Lagging	-16.53	0.992	Lagging	-36.97	0.999	Lagging	-15.60
73	FLT95-3PH	0.876	Lagging	-165.21	0.978	Lagging	-64.14	0.998	Lagging	-16.53	0.993	Lagging	-35.53	0.998	Lagging	-17.22
74	FLT96-3PH	0.871	Lagging	-168.93	0.976	Lagging	-66.30	0.998	Lagging	-16.80	0.992	Lagging	-37.18	0.999	Lagging	-15.92
75	FLT97-3PH	0.871	Lagging	-169.04	0.976	Lagging	-66.49	0.998	Lagging	-16.75	0.992	Lagging	-37.15	0.999	Lagging	-15.97
76	FLT98-3PH	0.871	Lagging	-169.05	0.976	Lagging	-66.38	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.93
77	FLT99-3PH	0.871	Lagging	-168.92	0.976	Lagging	-66.30	0.998	Lagging	-16.82	0.992	Lagging	-37.20	0.999	Lagging	-15.93
78	FLT100-3PH	0.871	Lagging	-169.09	0.976	Lagging	-66.53	0.998	Lagging	-16.77	0.992	Lagging	-37.17	0.999	Lagging	-16.02
79	FLT101-3PH	0.871	Lagging	-169.09	0.976	Lagging	-66.44	0.998	Lagging	-16.85	0.992	Lagging	-37.26	0.999	Lagging	-15.99
80	FLT102-3PH	0.872	Lagging	-168.73	0.977	Lagging	-66.17	0.998	Lagging	-16.84	0.992	Lagging	-37.17	0.999	Lagging	-15.95
81	FLT105-3PH	0.876	Lagging	-164.97	0.977	Lagging	-65.26	0.999	Lagging	-15.76	0.993	Lagging	-36.30	0.998	Lagging	-17.15
82	FLT106-3PH	0.885	Lagging	-157.79	0.976	Lagging	-66.23	0.998	Lagging	-17.72	0.992	Lagging	-37.43	0.998	Lagging	-17.10
83	FLT107-3PH	0.870	Lagging	-170.26	0.976	Lagging	-67.63	0.998	Lagging	-18.43	0.992	Lagging	-37.73	0.999	Lagging	-15.85
84	FLT108-3PH	0.883	Lagging	-159.50	0.979	Lagging	-63.02	0.999	Lagging	-14.44	0.992	Lagging	-38.01	0.999	Lagging	-15.66
85	FLT109-3PH	0.871	Lagging	-169.07	0.976	Lagging	-66.43	0.998	Lagging	-16.87	0.992	Lagging	-37.26	0.999	Lagging	-15.96
86	FLT111-3PH	0.872	Lagging	-168.79	0.976	Lagging	-66.35	0.998	Lagging	-16.88	0.992	Lagging	-37.30	0.999	Lagging	-15.97
87	FLT112-3PH	0.871	Lagging	-168.85	0.976	Lagging	-66.44	0.998	Lagging	-16.93	0.992	Lagging	-37.28	0.999	Lagging	-16.03
88	FLT113-3PH	0.871	Lagging	-169.02	0.977	Lagging	-66.15	0.998	Lagging	-16.71	0.992	Lagging	-37.26	0.999	Lagging	-16.26
89	FLT114-3PH	0.871	Lagging	-169.00	0.976	Lagging	-66.57	0.998	Lagging	-16.94	0.992	Lagging	-37.19	0.999	Lagging	-16.05
90	FLT115-3PH	0.871	Lagging	-169.01	0.976	Lagging	-66.36	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
91	FLT116-3PH	0.871	Lagging	-169.09	0.976	Lagging	-66.51	0.998	Lagging	-16.90	0.992	Lagging	-37.23	0.999	Lagging	-15.99
92	FLT117-3PH	0.871	Lagging	-168.92	0.976	Lagging	-66.73	0.998	Lagging	-17.17	0.992	Lagging	-37.33	0.999	Lagging	-15.72
93	FLT118-3PH	0.871	Lagging	-168.99	0.976	Lagging	-66.43	0.998	Lagging	-16.65	0.992	Lagging	-37.20	0.999	Lagging	-15.60
94	FLT119-3PH	0.871	Lagging	-169.36	0.976	Lagging	-66.47	0.998	Lagging	-17.53	0.992	Lagging	-38.11	0.998	Lagging	-16.74
95	FLT120-3PH	0.871	Lagging	-169.11	0.977	Lagging	-66.05	0.999	Lagging	-15.69	0.993	Lagging	-36.21	0.999	Lagging	-15.12
96	FLT121-3PH	0.871	Lagging	-169.12	0.976	Lagging	-66.50	0.998	Lagging	-16.91	0.992	Lagging	-37.32	0.999	Lagging	-16.01
97	FLT126-3PH	0.870	Lagging	-169.82	0.975	Lagging	-68.24	0.998	Lagging	-19.50	0.991	Lagging	-39.56	0.998	Lagging	-20.01
98	FLT127-3PH	0.871	Lagging	-169.27	0.977	Lagging	-66.04	0.998	Lagging	-16.80	0.992	Lagging	-37.20	0.999	Lagging	-15.92
99	FLT128-3PH	0.871	Lagging	-168.94	0.976	Lagging	-66.34	0.998	Lagging	-16.46	0.993	Lagging	-36.91	0.999	Lagging	-15.82
100	FLT129-3PH	0.871	Lagging	-169.07	0.976	Lagging	-66.47	0.998	Lagging	-16.98	0.992	Lagging	-37.37	0.999	Lagging	-16.08

Study Generator GEN-2015-068

The Power Factor Analysis shows that GEN-2015-068 has a power factor range of 0.737 to 0.891 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.889 to 0.984 lagging (supplying) for the 2017 Summer Peak conditions, a power factor range of 0.960 lagging (supplying) to 1.00 (unity) for the 2020 Summer Peak conditions, a power factor range of 0.914 to 0.995 lagging (supplying) for the 2020 Winter Peak conditions, and a power factor range of 0.976 lagging (supplying) to 1.00 (unity) for the 2025 Summer Peak conditions.

Table 5-6
Power Factor Analysis: GEN-2015-075

Cont. No.	Case	2016 Winter Peak Power Factor		2016 Winter Peak Q (MVAR)	2017 Summer Peak Power Factor		2017 Summer Peak Q (MVAR)	2020 Summer Peak Power Factor		2020 Summer Peak Q (MVAR)	2020 Winter Peak Power Factor		2020 Winter Peak Q (MVAR)	2025 Summer Peak Power Factor		2025 Summer Peak Q (MVAR)
0	Base	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
1	FLT01-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
2	FLT02-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
3	FLT03-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
4	FLT04-3PH	0.997	Leading	4.17	0.999	Leading	2.37	0.999	Leading	2.45	0.999	Leading	2.23	0.999	Leading	2.12
5	FLT05-3PH	0.997	Leading	4.19	0.999	Leading	2.41	0.999	Leading	2.48	0.999	Leading	2.25	0.999	Leading	2.21
6	FLT06-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
7	FLT07-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
8	FLT11-3PH	0.997	Leading	4.19	0.999	Leading	2.45	0.999	Leading	2.51	0.999	Leading	2.29	0.999	Leading	2.26
9	FLT13-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
10	FLT14-3PH	0.997	Leading	4.17	0.999	Leading	2.38	0.999	Leading	2.46	0.999	Leading	2.26	0.999	Leading	2.22
11	FLT15-3PH	0.997	Leading	4.10	0.999	Leading	2.36	0.999	Leading	2.47	0.999	Leading	2.25	0.999	Leading	2.27
12	FLT16-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
13	FLT17-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
14	FLT18-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
15	FLT19-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
16	FLT20-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
17	FLT21-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
18	FLT22-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
19	FLT23-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
20	FLT24-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
21	FLT25-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
22	FLT26-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
23	FLT27-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
24	FLT28-3PH	0.997	Leading	4.16	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
25	FLT29-3PH	0.996	Leading	4.18	0.999	Leading	2.44	0.999	Leading	2.54	0.999	Leading	2.31	0.999	Leading	2.30
26	FLT30-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
27	FLT31-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
28	FLT34-3PH	0.997	Leading	3.58	0.999	Leading	2.11	0.999	Leading	2.31	0.999	Leading	2.01	0.999	Leading	2.24
29	FLT35-3PH	0.997	Leading	3.81	0.999	Leading	2.24	0.999	Leading	2.39	0.999	Leading	2.18	0.999	Leading	2.24
30	FLT36-3PH	0.997	Leading	4.06	0.999	Leading	2.26	0.999	Leading	2.35	0.999	Leading	2.18	0.999	Leading	2.01
31	FLT37-3PH	0.997	Leading	3.70	0.999	Leading	2.42	0.999	Leading	2.58	0.999	Leading	2.07	0.999	Leading	2.22
32	FLT38-3PH	0.997	Leading	4.10	0.999	Leading	2.47	0.999	Leading	2.58	0.999	Leading	2.30	0.999	Leading	2.26
33	FLT39-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
34	FLT40-3PH	0.997	Leading	4.18	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
35	FLT41-3PH	0.997	Leading	4.17	0.999	Leading	2.40	0.999	Leading	2.49	0.999	Leading	2.26	0.999	Leading	2.26
36	FLT43-3PH	0.999	Leading	2.59	1.000	Leading	1.53	0.999	Leading	2.04	0.999	Leading	1.66	0.999	Leading	2.18
37	FLT45-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
38	FLT46-3PH	0.996	Leading	4.20	0.999	Leading	2.49	0.999	Leading	2.54	0.999	Leading	2.39	0.999	Leading	2.25
39	FLT47-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
40	FLT48-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
41	FLT49-3PH	0.997	Leading	3.75	0.999	Leading	2.09	0.999	Leading	2.42	0.999	Leading	2.08	0.999	Leading	2.32
42	FLT52-3PH	0.998	Leading	3.52	0.999	Leading	2.00	0.999	Leading	2.22	0.999	Leading	1.97	0.999	Leading	2.25
43	FLT54-3PH	0.998	Leading	3.23	0.999	Leading	2.03	0.999	Leading	2.28	0.999	Leading	1.84	0.999	Leading	2.23
44	FLT55-3PH	0.997	Leading	4.16	0.999	Leading	2.41	0.999	Leading	2.49	0.999	Leading	2.27	0.999	Leading	2.26
45	FLT56-3PH	0.997	Leading	4.11	0.999	Leading	2.33	0.999	Leading	2.47	0.999	Leading	2.27	0.999	Leading	2.28
46	FLT57-3PH	0.997	Leading	3.61	0.999	Leading	2.15	0.999	Leading	2.30	0.999	Leading	2.08	0.999	Leading	2.28
47	FLT58-3PH	0.997	Leading	4.10	0.999	Leading	2.32	0.999	Leading	2.47	0.999	Leading	2.27	0.999	Leading	2.28
48	FLT59-3PH	0.998	Leading	3.12	1.000	Leading	0.94	1.000	Leading	1.35	1.000	Leading	1.29	1.000	Leading	0.85
49	FLT60-3PH	0.997	Leading	4.19	0.999	Leading	2.50	0.999	Leading	2.57	0.999	Leading	2.30	0.999	Leading	2.29
50	FLT63-3PH	0.997	Leading	4.16	0.999	Leading	2.39	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.25
51	FLT64-3PH	0.996	Leading	4.20	0.999	Leading	2.42	0.999	Leading	2.52	0.999	Leading	2.31	0.999	Leading	2.25
52	FLT65-3PH	0.997	Leading	4.16	0.999	Leading	2.39	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.24
53	FLT66-3PH	0.997	Leading	4.15	0.999	Leading	2.45	0.999	Leading	2.45	0.999	Leading	2.25	0.999	Leading	2.17
54	FLT67-3PH	0.997	Leading	4.17	0.999	Leading	2.43	0.999	Leading	2.48	0.999	Leading	2.27	0.999	Leading	2.23
55	FLT68-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.51	0.999	Leading	2.28	0.999	Leading	2.24
56	FLT69-3PH	0.997	Leading	3.89	0.999	Leading	2.00	0.999	Leading	2.27	0.999	Leading	2.08	0.999	Leading	1.85
57	FLT70-3PH	0.997	Leading	4.10	0.999	Leading	2.30	0.999	Leading	2.44	0.999	Leading	2.19	0.999	Leading	2.08
58	FLT71-3PH	0.997	Leading	4.11	0.999	Leading	2.39	0.999	Leading	2.46	0.999	Leading	2.24	0.999	Leading	2.22
59	FLT72-3PH	0.997	Leading	4.15	0.999	Leading	2.19	0.999	Leading	2.28	0.999	Leading	2.25	0.999	Leading	2.01
60	FLT73-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
61	FLT74-3PH	0.997	Leading	4.17	0.999	Leading	2.37	0.999	Leading	2.46	0.999	Leading	2.24	0.999	Leading	2.23
62	FLT75-3PH	0.997	Leading	3.90	0.999	Leading	2.05	0.999	Leading	2.01	0.999	Leading	1.94	0.999	Leading	1.79
63	FLT76-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.51	0.999	Leading	2.28	0.999	Leading	2.24
64	FLT77-3PH	0.997	Leading	3.84	0.999	Leading	1.77	0.999	Leading	2.34	0.999	Leading	2.20	0.999	Leading	1.98
65	FLT84-3PH	0.996	Leading	4.36	0.999	Leading	2.52	0.999	Leading	2.62	0.999	Leading	2.45	0.999	Leading	2.28
66	FLT85-3PH	0.998	Leading	3.05	1.000	Leading	0.94	1.000	Leading	1.39	1.000	Leading	1.39	1.000	Leading	0.26
67	FLT86-3PH	0.998	Leading	2.97	0.999	Leading	2.09	0.999	Leading	2.43	0.999	Leading	1.89	0.999	Leading	2.19
68	FLT87-3PH	0.998	Leading	3.54	0.999	Leading	2.52	0.999	Leading	2.43	0.999	Leading	2.13	0.999	Leading	2.13
69	FLT88-3PH	0.997	Leading	3.81	0.999	Leading	2.04	0.999	Leading	2.03	0.999	Leading	2.05	0.999	Leading	2.11
70	FLT92-3PH	0.996	Leading	4.20	0.999	Leading	2.47	0.999	Leading	2.60	0.999	Leading	2.36	0.999	Leading	2.38

Table 5-6 (continued)
Power Factor Analysis: GEN-2015-075

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	0.997	Leading	4.06	0.999	Leading	2.13	0.999	Leading	2.29	0.999	Leading	2.11	0.999	Leading	1.77
72	FLT94-3PH	0.996	Leading	4.20	0.999	Leading	2.47	0.999	Leading	2.60	0.999	Leading	2.36	0.999	Leading	2.38
73	FLT95-3PH	0.997	Leading	4.06	0.999	Leading	2.13	0.999	Leading	2.28	0.999	Leading	2.11	0.999	Leading	1.77
74	FLT96-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
75	FLT97-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
76	FLT98-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.26
77	FLT99-3PH	0.997	Leading	4.18	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
78	FLT100-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
79	FLT101-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
80	FLT102-3PH	0.997	Leading	4.18	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.25
81	FLT105-3PH	0.994	Leading	5.56	0.995	Leading	4.78	0.995	Leading	5.14	0.996	Leading	4.39	0.995	Leading	5.21
82	FLT106-3PH	1.000	Lagging	-0.99	1.000	Lagging	-0.86	1.000	Lagging	-1.40	1.000	Lagging	-0.49	0.994	Lagging	-5.47
83	FLT107-3PH	0.994	Leading	5.68	0.998	Leading	3.39	0.997	Leading	3.57	0.999	Leading	2.63	0.996	Leading	4.67
84	FLT108-3PH	0.986	Leading	8.59	0.994	Leading	5.72	0.994	Leading	5.47	1.000	Leading	0.96	0.990	Leading	7.15
85	FLT109-3PH	0.997	Leading	4.15	0.999	Leading	2.38	0.999	Leading	2.47	0.999	Leading	2.26	0.999	Leading	2.23
86	FLT111-3PH	0.996	Leading	4.39	0.999	Leading	2.45	0.999	Leading	2.54	0.999	Leading	2.35	0.999	Leading	2.24
87	FLT112-3PH	0.996	Leading	4.34	0.999	Leading	2.41	0.999	Leading	2.52	0.999	Leading	2.33	0.999	Leading	2.27
88	FLT113-3PH	0.996	Leading	4.24	0.999	Leading	2.55	0.999	Leading	2.67	0.999	Leading	2.30	0.999	Leading	2.48
89	FLT114-3PH	0.997	Leading	4.16	0.999	Leading	2.35	0.999	Leading	2.46	0.999	Leading	2.27	0.999	Leading	2.20
90	FLT115-3PH	0.997	Leading	4.17	0.999	Leading	2.42	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
91	FLT116-3PH	0.997	Leading	4.11	0.999	Leading	2.19	0.999	Leading	2.30	0.999	Leading	2.29	0.999	Leading	2.08
92	FLT117-3PH	0.996	Leading	4.22	0.999	Leading	2.19	0.999	Leading	2.24	0.999	Leading	2.20	0.999	Leading	1.93
93	FLT118-3PH	0.997	Leading	4.15	0.999	Leading	2.36	0.999	Leading	2.44	0.999	Leading	2.25	0.999	Leading	2.16
94	FLT119-3PH	0.997	Leading	4.17	0.999	Leading	2.39	0.999	Leading	2.47	0.999	Leading	2.25	0.999	Leading	2.25
95	FLT120-3PH	0.996	Leading	4.32	0.999	Leading	2.59	0.999	Leading	2.65	0.999	Leading	2.40	0.999	Leading	2.44
96	FLT121-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.25
97	FLT126-3PH	0.997	Leading	3.98	0.999	Leading	2.16	0.999	Leading	2.36	0.999	Leading	2.14	0.999	Leading	2.07
98	FLT127-3PH	0.997	Leading	4.16	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.27	0.999	Leading	2.26
99	FLT128-3PH	0.997	Leading	4.18	0.999	Leading	2.42	0.999	Leading	2.49	0.999	Leading	2.26	0.999	Leading	2.23
100	FLT129-3PH	0.997	Leading	4.17	0.999	Leading	2.41	0.999	Leading	2.50	0.999	Leading	2.28	0.999	Leading	2.25

Study Generator GEN-2015-075

The Power Factor Analysis shows that GEN-2015-075 has a power factor range of 0.986 leading (absorbing) to 1.00 (unity) for the 2016 Winter Peak conditions, a power factor range of 0.994 leading (absorbing) to 1.00 (unity) for the 2017 Summer Peak conditions, a power factor range of 0.994 leading (absorbing) to 1.00 (unity) for the 2020 Summer Peak conditions, a power factor range of 0.996 leading (absorbing) to 1.00 (unity) for the 2020 Winter Peak conditions, and a power factor range of 0.990 leading (absorbing) to 1.00 (unity) for the 2025 Summer Peak conditions.

Table 5-7
Power Factor Analysis: GEN-2015-079

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
1	FLT01-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.15
2	FLT02-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.00	0.995	Leading	13.15
3	FLT03-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.17
4	FLT04-3PH	0.999	Leading	5.12	0.993	Lagging	-15.28	0.997	Leading	9.17	0.993	Leading	15.75	0.996	Leading	11.93
5	FLT05-3PH	0.999	Leading	5.63	0.993	Lagging	-15.27	0.997	Leading	9.18	0.993	Leading	15.91	0.995	Leading	12.76
6	FLT06-3PH	0.999	Leading	6.01	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.16
7	FLT07-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.15
8	FLT11-3PH	0.999	Leading	6.01	0.993	Lagging	-15.51	0.998	Leading	9.06	0.992	Leading	15.99	0.995	Leading	13.10
9	FLT13-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.14	0.992	Leading	16.01	0.995	Leading	13.16
10	FLT14-3PH	0.999	Leading	6.01	0.993	Lagging	-15.41	0.998	Leading	9.08	0.992	Leading	15.96	0.995	Leading	13.09
11	FLT15-3PH	0.999	Leading	5.93	0.993	Lagging	-15.65	0.998	Leading	8.95	0.993	Leading	15.85	0.995	Leading	13.10
12	FLT16-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
13	FLT17-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
14	FLT18-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
15	FLT19-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
16	FLT20-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
17	FLT21-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.16
18	FLT22-3PH	0.999	Leading	6.01	0.993	Lagging	-15.48	0.998	Leading	9.13	0.992	Leading	15.99	0.995	Leading	13.16
19	FLT23-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.17
20	FLT24-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
21	FLT25-3PH	0.999	Leading	6.02	0.993	Lagging	-15.47	0.997	Leading	9.15	0.992	Leading	16.01	0.995	Leading	13.18
22	FLT26-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
23	FLT27-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
24	FLT28-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	15.99	0.995	Leading	13.17
25	FLT29-3PH	0.999	Leading	6.16	0.993	Lagging	-15.87	0.998	Leading	9.02	0.992	Leading	16.06	0.995	Leading	13.44
26	FLT30-3PH	0.999	Leading	6.04	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.02	0.995	Leading	13.16
27	FLT31-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
28	FLT34-3PH	0.999	Leading	5.99	0.993	Lagging	-15.46	0.998	Leading	8.91	0.993	Leading	15.61	0.995	Leading	13.14
29	FLT35-3PH	0.999	Leading	5.96	0.993	Lagging	-15.51	0.998	Leading	9.04	0.993	Leading	15.88	0.995	Leading	13.16
30	FLT36-3PH	0.999	Leading	5.99	0.993	Lagging	-15.48	0.997	Leading	9.19	0.992	Leading	16.00	0.995	Leading	13.16
31	FLT37-3PH	0.999	Leading	5.42	0.993	Lagging	-15.44	0.997	Leading	9.28	0.993	Leading	15.59	0.995	Leading	13.14
32	FLT38-3PH	0.999	Leading	5.71	0.993	Lagging	-15.54	0.997	Leading	9.17	0.993	Leading	15.85	0.995	Leading	13.14
33	FLT39-3PH	0.999	Leading	6.03	0.993	Lagging	-15.44	0.997	Leading	9.17	0.992	Leading	16.02	0.995	Leading	13.18
34	FLT40-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
35	FLT41-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.998	Leading	9.15	0.992	Leading	15.99	0.995	Leading	13.17
36	FLT43-3PH	0.999	Leading	6.56	0.993	Lagging	-14.90	0.998	Leading	8.45	0.993	Leading	14.99	0.995	Leading	12.94
37	FLT45-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
38	FLT46-3PH	0.999	Leading	6.13	0.993	Lagging	-15.38	0.998	Leading	9.01	0.993	Leading	15.67	0.995	Leading	13.28
39	FLT47-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
40	FLT48-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
41	FLT49-3PH	0.999	Leading	6.74	0.994	Lagging	-14.68	0.997	Leading	9.29	0.993	Leading	15.90	0.995	Leading	13.51
42	FLT52-3PH	0.999	Leading	5.32	0.992	Lagging	-16.27	0.998	Leading	7.99	0.993	Leading	14.84	0.995	Leading	12.59
43	FLT54-3PH	0.999	Leading	5.17	0.992	Lagging	-16.14	0.998	Leading	8.39	0.994	Leading	14.67	0.995	Leading	12.85
44	FLT55-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.998	Leading	9.13	0.992	Leading	16.00	0.995	Leading	13.15
45	FLT56-3PH	0.999	Leading	5.58	0.992	Lagging	-16.16	0.998	Leading	8.66	0.993	Leading	15.72	0.995	Leading	12.88
46	FLT57-3PH	0.999	Leading	5.02	0.992	Lagging	-16.43	0.998	Leading	8.00	0.993	Leading	14.82	0.995	Leading	12.63
47	FLT58-3PH	0.999	Leading	5.54	0.992	Lagging	-16.22	0.998	Leading	8.62	0.993	Leading	15.70	0.995	Leading	12.85
48	FLT59-3PH	1.000	Lagging	-2.38	0.983	Lagging	-23.86	1.000	Leading	3.61	0.996	Leading	11.24	0.999	Leading	6.90
49	FLT60-3PH	0.999	Leading	6.01	0.993	Lagging	-15.60	0.998	Leading	8.95	0.992	Leading	15.99	0.995	Leading	13.14
50	FLT63-3PH	0.999	Leading	5.20	0.992	Lagging	-16.65	0.998	Leading	9.11	0.992	Leading	16.02	0.995	Leading	12.90
51	FLT64-3PH	0.999	Leading	5.19	0.988	Lagging	-20.08	0.998	Leading	7.56	0.994	Leading	14.62	0.997	Leading	9.57
52	FLT65-3PH	0.999	Leading	5.27	0.992	Lagging	-16.28	0.997	Leading	9.37	0.992	Leading	16.17	0.995	Leading	13.06
53	FLT66-3PH	0.997	Leading	10.27	0.999	Lagging	-6.07	0.994	Leading	14.44	0.987	Leading	21.08	0.988	Leading	19.79
54	FLT67-3PH	0.999	Leading	6.64	0.994	Lagging	-13.75	0.998	Leading	8.34	0.992	Leading	16.56	0.995	Leading	13.13
55	FLT68-3PH	0.999	Leading	5.80	0.993	Lagging	-15.70	0.997	Leading	9.89	0.992	Leading	16.66	0.995	Leading	13.53
56	FLT69-3PH	1.000	Leading	0.37	0.985	Lagging	-22.39	0.999	Leading	6.94	0.995	Leading	13.57	0.996	Leading	11.29
57	FLT70-3PH	0.999	Leading	6.83	0.993	Lagging	-14.88	0.997	Leading	9.18	0.991	Leading	16.97	0.995	Leading	13.03
58	FLT71-3PH	0.999	Leading	5.87	0.993	Lagging	-15.46	0.998	Leading	9.08	0.993	Leading	15.87	0.995	Leading	13.08
59	FLT72-3PH	0.999	Leading	5.88	0.992	Lagging	-16.58	0.998	Leading	8.10	0.993	Leading	15.74	0.996	Leading	12.24
60	FLT73-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
61	FLT74-3PH	0.999	Leading	6.02	0.992	Lagging	-16.06	0.998	Leading	8.62	0.993	Leading	15.50	0.995	Leading	12.71
62	FLT75-3PH	0.997	Leading	9.40	0.996	Lagging	-12.27	0.995	Leading	13.06	0.991	Leading	17.79	0.990	Leading	18.62
63	FLT76-3PH	0.999	Leading	5.79	0.993	Lagging	-15.68	0.997	Leading	9.90	0.992	Leading	16.69	0.995	Leading	13.50
64	FLT77-3PH	0.982	Leading	24.87	0.982	Leading	24.87	0.982	Leading	24.87	0.985	Leading	22.52	0.958	Leading	38.67
65	FLT84-3PH	0.999	Leading	6.26	0.993	Lagging	-15.34	0.997	Leading	9.54	0.992	Leading	16.54	0.995	Leading	13.36
66	FLT85-3PH	0.999	Leading	5.64	0.992	Lagging	-16.87	0.998	Leading	8.64	0.993	Leading	15.71	0.996	Leading	12.14
67	FLT86-3PH	1.000	Leading	2.26	0.991	Lagging	-17.75	0.998	Leading	7.36	0.995	Leading	13.52	0.996	Leading	11.96
68	FLT87-3PH	0.999	Leading	6.26	0.993	Lagging	-15.44	0.998	Leading	9.06	0.993	Leading	15.89	0.995	Leading	13.01
69	FLT88-3PH	0.999	Leading	5.96	0.993	Lagging	-15.58	0.998	Leading	9.11	0.992	Leading	16.02	0.995	Leading	13.11
70	FLT92-3PH	0.999	Leading	5.85	0.991	Lagging	-17.55	0.998	Leading	8.50	0.993	Leading	15.82	0.994	Leading	14.06

Table 5-7 (continued)
Power Factor Analysis: GEN-2015-079

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	1.000	Leading	0.57	0.991	Lagging	-17.49	0.998	Leading	8.15	0.994	Leading	14.38	0.998	Leading	7.92
72	FLT94-3PH	0.999	Leading	5.85	0.991	Lagging	-17.55	0.998	Leading	8.49	0.993	Leading	15.82	0.994	Leading	14.06
73	FLT95-3PH	1.000	Leading	0.57	0.991	Lagging	-17.49	0.998	Leading	8.15	0.994	Leading	14.38	0.998	Leading	7.92
74	FLT96-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.16
75	FLT97-3PH	0.999	Leading	6.00	0.993	Lagging	-15.45	0.997	Leading	9.17	0.992	Leading	16.01	0.995	Leading	13.16
76	FLT98-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
77	FLT99-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.15
78	FLT100-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.18	0.992	Leading	16.02	0.995	Leading	13.17
79	FLT101-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
80	FLT102-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.998	Leading	9.13	0.992	Leading	15.98	0.995	Leading	13.10
81	FLT105-3PH	0.999	Leading	5.49	0.992	Lagging	-16.38	0.998	Leading	8.54	0.993	Leading	15.58	0.996	Leading	11.97
82	FLT106-3PH	0.999	Leading	5.28	0.993	Lagging	-15.69	0.998	Leading	8.89	0.993	Leading	15.88	0.995	Leading	12.66
83	FLT107-3PH	0.999	Leading	6.27	0.993	Lagging	-15.26	0.997	Leading	9.26	0.992	Leading	16.04	0.995	Leading	13.43
84	FLT108-3PH	0.999	Leading	6.47	0.993	Lagging	-14.92	0.997	Leading	9.52	0.993	Leading	15.86	0.994	Leading	13.70
85	FLT109-3PH	0.999	Leading	5.88	0.993	Lagging	-15.55	0.998	Leading	9.10	0.992	Leading	15.94	0.995	Leading	13.09
86	FLT111-3PH	0.999	Leading	5.06	0.993	Lagging	-15.62	0.998	Leading	8.96	0.993	Leading	15.65	0.995	Leading	13.10
87	FLT112-3PH	0.999	Leading	5.74	0.993	Lagging	-15.63	0.998	Leading	8.99	0.993	Leading	15.84	0.995	Leading	13.01
88	FLT113-3PH	0.999	Leading	5.47	0.992	Lagging	-16.05	0.998	Leading	8.66	0.993	Leading	15.75	0.995	Leading	12.39
89	FLT114-3PH	0.999	Leading	5.98	0.993	Lagging	-15.65	0.998	Leading	9.04	0.992	Leading	15.99	0.995	Leading	13.01
90	FLT115-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
91	FLT116-3PH	0.999	Leading	5.28	0.992	Lagging	-15.94	0.998	Leading	8.89	0.993	Leading	15.73	0.995	Leading	12.69
92	FLT117-3PH	0.999	Leading	5.94	0.993	Lagging	-15.41	0.998	Leading	9.13	0.992	Leading	15.95	0.995	Leading	13.25
93	FLT118-3PH	0.999	Leading	5.83	0.994	Lagging	-14.79	0.997	Leading	9.65	0.992	Leading	16.20	0.994	Leading	13.89
94	FLT119-3PH	0.999	Leading	4.93	0.992	Lagging	-16.18	0.998	Leading	7.12	0.993	Leading	14.93	0.996	Leading	11.16
95	FLT120-3PH	0.998	Leading	8.92	0.995	Lagging	-12.41	0.996	Leading	11.52	0.990	Leading	18.26	0.993	Leading	15.66
96	FLT121-3PH	0.999	Leading	5.97	0.993	Lagging	-15.52	0.998	Leading	9.10	0.992	Leading	15.97	0.995	Leading	13.09
97	FLT126-3PH	0.996	Lagging	-11.33	0.972	Lagging	-31.11	0.999	Lagging	-6.39	1.000	Leading	1.23	0.990	Lagging	-18.10
98	FLT127-3PH	0.999	Leading	5.54	0.992	Lagging	-16.09	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
99	FLT128-3PH	0.999	Leading	5.77	0.993	Lagging	-15.43	0.997	Leading	9.57	0.992	Leading	16.19	0.995	Leading	13.15
100	FLT129-3PH	0.999	Leading	5.68	0.992	Lagging	-16.02	0.998	Leading	8.90	0.993	Leading	15.79	0.995	Leading	12.83

Study Generator GEN-2015-079

The Power Factor Analysis shows that GEN-2015-079 has a power factor range of 0.982 leading (absorbing) to 0.996 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.982 leading (absorbing) to 0.972 lagging (supplying) for the 2017 Summer Peak conditions, a power factor range of 0.982 leading (absorbing) to 0.999 lagging (supplying) to for the 2020 Summer Peak conditions, a power factor range of 0.985 leading (absorbing) to 1.00 (unity) for the 2020 Winter Peak conditions, and a power factor range of 0.958 leading (absorbing) to 0.990 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-8
Power Factor Analysis: GEN-2015-080

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
1	FLT01-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.15
2	FLT02-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.00	0.995	Leading	13.15
3	FLT03-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.17
4	FLT04-3PH	0.999	Leading	5.12	0.993	Lagging	-15.28	0.997	Leading	9.17	0.993	Leading	15.75	0.996	Leading	11.93
5	FLT05-3PH	0.999	Leading	5.63	0.993	Lagging	-15.27	0.997	Leading	9.18	0.993	Leading	15.91	0.995	Leading	12.76
6	FLT06-3PH	0.999	Leading	6.01	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.16
7	FLT07-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.15
8	FLT11-3PH	0.999	Leading	6.01	0.993	Lagging	-15.51	0.998	Leading	9.06	0.992	Leading	15.99	0.995	Leading	13.10
9	FLT13-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.14	0.992	Leading	16.01	0.995	Leading	13.16
10	FLT14-3PH	0.999	Leading	6.01	0.993	Lagging	-15.41	0.998	Leading	9.08	0.992	Leading	15.96	0.995	Leading	13.09
11	FLT15-3PH	0.999	Leading	5.93	0.993	Lagging	-15.65	0.998	Leading	8.95	0.993	Leading	15.85	0.995	Leading	13.10
12	FLT16-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
13	FLT17-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
14	FLT18-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
15	FLT19-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
16	FLT20-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
17	FLT21-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.16
18	FLT22-3PH	0.999	Leading	6.01	0.993	Lagging	-15.48	0.998	Leading	9.13	0.992	Leading	15.99	0.995	Leading	13.16
19	FLT23-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	16.00	0.995	Leading	13.17
20	FLT24-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
21	FLT25-3PH	0.999	Leading	6.02	0.993	Lagging	-15.47	0.997	Leading	9.15	0.992	Leading	16.01	0.995	Leading	13.18
22	FLT26-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
23	FLT27-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
24	FLT28-3PH	0.999	Leading	6.01	0.993	Lagging	-15.47	0.998	Leading	9.14	0.992	Leading	15.99	0.995	Leading	13.17
25	FLT29-3PH	0.999	Leading	6.16	0.993	Lagging	-15.87	0.998	Leading	9.02	0.992	Leading	16.06	0.995	Leading	13.44
26	FLT30-3PH	0.999	Leading	6.04	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.02	0.995	Leading	13.16
27	FLT31-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
28	FLT34-3PH	0.999	Leading	5.99	0.993	Lagging	-15.46	0.998	Leading	8.91	0.993	Leading	15.61	0.995	Leading	13.14
29	FLT35-3PH	0.999	Leading	5.96	0.993	Lagging	-15.51	0.998	Leading	9.04	0.993	Leading	15.88	0.995	Leading	13.16
30	FLT36-3PH	0.999	Leading	5.99	0.993	Lagging	-15.48	0.997	Leading	9.19	0.992	Leading	16.00	0.995	Leading	13.16
31	FLT37-3PH	0.999	Leading	5.42	0.993	Lagging	-15.44	0.997	Leading	9.28	0.993	Leading	15.59	0.995	Leading	13.14
32	FLT38-3PH	0.999	Leading	5.71	0.993	Lagging	-15.54	0.997	Leading	9.17	0.993	Leading	15.85	0.995	Leading	13.14
33	FLT39-3PH	0.999	Leading	6.03	0.993	Lagging	-15.44	0.997	Leading	9.17	0.992	Leading	16.02	0.995	Leading	13.18
34	FLT40-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.17
35	FLT41-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.998	Leading	9.15	0.992	Leading	15.99	0.995	Leading	13.17
36	FLT43-3PH	0.999	Leading	6.56	0.993	Lagging	-14.90	0.998	Leading	8.45	0.993	Leading	14.99	0.995	Leading	12.94
37	FLT45-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
38	FLT46-3PH	0.999	Leading	6.13	0.993	Lagging	-15.38	0.998	Leading	9.01	0.993	Leading	15.67	0.995	Leading	13.28
39	FLT47-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
40	FLT48-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
41	FLT49-3PH	0.999	Leading	6.74	0.994	Lagging	-14.68	0.997	Leading	9.29	0.993	Leading	15.90	0.995	Leading	13.51
42	FLT52-3PH	0.999	Leading	5.32	0.992	Lagging	-16.27	0.998	Leading	7.99	0.993	Leading	14.84	0.995	Leading	12.59
43	FLT54-3PH	0.999	Leading	5.17	0.992	Lagging	-16.14	0.998	Leading	8.39	0.994	Leading	14.67	0.995	Leading	12.85
44	FLT55-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.998	Leading	9.13	0.992	Leading	16.00	0.995	Leading	13.15
45	FLT56-3PH	0.999	Leading	5.58	0.992	Lagging	-16.16	0.998	Leading	8.66	0.993	Leading	15.72	0.995	Leading	12.88
46	FLT57-3PH	0.999	Leading	5.02	0.992	Lagging	-16.43	0.998	Leading	8.00	0.993	Leading	14.82	0.995	Leading	12.63
47	FLT58-3PH	0.999	Leading	5.54	0.992	Lagging	-16.22	0.998	Leading	8.62	0.993	Leading	15.70	0.995	Leading	12.85
48	FLT59-3PH	1.000	Lagging	-2.38	0.983	Lagging	-23.86	1.000	Leading	3.61	0.996	Leading	11.24	0.999	Leading	6.90
49	FLT60-3PH	0.999	Leading	6.01	0.993	Lagging	-15.60	0.998	Leading	8.95	0.992	Leading	15.99	0.995	Leading	13.14
50	FLT63-3PH	0.999	Leading	5.20	0.992	Lagging	-16.65	0.998	Leading	9.11	0.992	Leading	16.02	0.995	Leading	12.90
51	FLT64-3PH	0.999	Leading	5.19	0.988	Lagging	-20.08	0.998	Leading	7.56	0.994	Leading	14.62	0.997	Leading	9.57
52	FLT65-3PH	0.999	Leading	5.27	0.992	Lagging	-16.28	0.997	Leading	9.37	0.992	Leading	16.17	0.995	Leading	13.06
53	FLT66-3PH	0.997	Leading	10.27	0.999	Lagging	-6.07	0.994	Leading	14.44	0.987	Leading	21.08	0.988	Leading	19.79
54	FLT67-3PH	0.999	Leading	6.64	0.994	Lagging	-13.75	0.998	Leading	8.34	0.992	Leading	16.56	0.995	Leading	13.13
55	FLT68-3PH	0.999	Leading	5.80	0.993	Lagging	-15.70	0.997	Leading	9.89	0.992	Leading	16.66	0.995	Leading	13.53
56	FLT69-3PH	1.000	Leading	0.37	0.985	Lagging	-22.39	0.999	Leading	6.94	0.995	Leading	13.57	0.996	Leading	11.29
57	FLT70-3PH	0.999	Leading	6.83	0.993	Lagging	-14.88	0.997	Leading	9.18	0.991	Leading	16.97	0.995	Leading	13.03
58	FLT71-3PH	0.999	Leading	5.87	0.993	Lagging	-15.46	0.998	Leading	9.08	0.993	Leading	15.87	0.995	Leading	13.08
59	FLT72-3PH	0.999	Leading	5.88	0.992	Lagging	-16.58	0.998	Leading	8.10	0.993	Leading	15.74	0.996	Leading	12.24
60	FLT73-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
61	FLT74-3PH	0.999	Leading	6.02	0.992	Lagging	-16.06	0.998	Leading	8.62	0.993	Leading	15.50	0.995	Leading	12.71
62	FLT75-3PH	0.997	Leading	9.40	0.996	Lagging	-12.27	0.995	Leading	13.06	0.991	Leading	17.79	0.990	Leading	18.62
63	FLT76-3PH	0.999	Leading	5.79	0.993	Lagging	-15.68	0.997	Leading	9.90	0.992	Leading	16.69	0.995	Leading	13.50
64	FLT77-3PH	0.982	Leading	24.87	0.982	Leading	24.87	0.982	Leading	24.87	0.985	Leading	22.52	0.958	Leading	38.67
65	FLT84-3PH	0.999	Leading	6.26	0.993	Lagging	-15.34	0.997	Leading	9.54	0.992	Leading	16.54	0.995	Leading	13.36
66	FLT85-3PH	0.999	Leading	5.64	0.992	Lagging	-16.87	0.998	Leading	8.64	0.993	Leading	15.71	0.996	Leading	12.14
67	FLT86-3PH	1.000	Leading	2.26	0.991	Lagging	-17.75	0.998	Leading	7.36	0.995	Leading	13.52	0.996	Leading	11.96
68	FLT87-3PH	0.999	Leading	6.26	0.993	Lagging	-15.44	0.998	Leading	9.06	0.993	Leading	15.89	0.995	Leading	13.01
69	FLT88-3PH	0.999	Leading	5.96	0.993	Lagging	-15.58	0.998	Leading	9.11	0.992	Leading	16.02	0.995	Leading	13.11
70	FLT92-3PH	0.999	Leading	5.85	0.991	Lagging	-17.55	0.998	Leading	8.50	0.993	Leading	15.82	0.994	Leading	14.06

Table 5-8 (continued)
Power Factor Analysis: GEN-2015-080

		2016 Winter Peak			2017 Summer Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
Cont. No.	Case	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
71	FLT93-3PH	1.000	Leading	0.57	0.991	Lagging	-17.49	0.998	Leading	8.15	0.994	Leading	14.38	0.998	Leading	7.92
72	FLT94-3PH	0.999	Leading	5.85	0.991	Lagging	-17.55	0.998	Leading	8.49	0.993	Leading	15.82	0.994	Leading	14.06
73	FLT95-3PH	1.000	Leading	0.57	0.991	Lagging	-17.49	0.998	Leading	8.15	0.994	Leading	14.38	0.998	Leading	7.92
74	FLT96-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.16
75	FLT97-3PH	0.999	Leading	6.00	0.993	Lagging	-15.45	0.997	Leading	9.17	0.992	Leading	16.01	0.995	Leading	13.16
76	FLT98-3PH	0.999	Leading	6.02	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
77	FLT99-3PH	0.999	Leading	6.01	0.993	Lagging	-15.45	0.998	Leading	9.15	0.992	Leading	16.00	0.995	Leading	13.15
78	FLT100-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.18	0.992	Leading	16.02	0.995	Leading	13.17
79	FLT101-3PH	0.999	Leading	6.01	0.993	Lagging	-15.46	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
80	FLT102-3PH	0.999	Leading	6.00	0.993	Lagging	-15.44	0.998	Leading	9.13	0.992	Leading	15.98	0.995	Leading	13.10
81	FLT105-3PH	0.999	Leading	5.49	0.992	Lagging	-16.38	0.998	Leading	8.54	0.993	Leading	15.58	0.996	Leading	11.97
82	FLT106-3PH	0.999	Leading	5.28	0.993	Lagging	-15.69	0.998	Leading	8.89	0.993	Leading	15.88	0.995	Leading	12.66
83	FLT107-3PH	0.999	Leading	6.27	0.993	Lagging	-15.26	0.997	Leading	9.26	0.992	Leading	16.04	0.995	Leading	13.43
84	FLT108-3PH	0.999	Leading	6.47	0.993	Lagging	-14.92	0.997	Leading	9.52	0.993	Leading	15.86	0.994	Leading	13.70
85	FLT109-3PH	0.999	Leading	5.88	0.993	Lagging	-15.55	0.998	Leading	9.10	0.992	Leading	15.94	0.995	Leading	13.09
86	FLT111-3PH	0.999	Leading	5.06	0.993	Lagging	-15.62	0.998	Leading	8.96	0.993	Leading	15.65	0.995	Leading	13.10
87	FLT112-3PH	0.999	Leading	5.74	0.993	Lagging	-15.63	0.998	Leading	8.99	0.993	Leading	15.84	0.995	Leading	13.01
88	FLT113-3PH	0.999	Leading	5.47	0.992	Lagging	-16.05	0.998	Leading	8.66	0.993	Leading	15.75	0.995	Leading	12.39
89	FLT114-3PH	0.999	Leading	5.98	0.993	Lagging	-15.65	0.998	Leading	9.04	0.992	Leading	15.99	0.995	Leading	13.01
90	FLT115-3PH	0.999	Leading	6.02	0.993	Lagging	-15.45	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
91	FLT116-3PH	0.999	Leading	5.28	0.992	Lagging	-15.94	0.998	Leading	8.89	0.993	Leading	15.73	0.995	Leading	12.69
92	FLT117-3PH	0.999	Leading	5.94	0.993	Lagging	-15.41	0.998	Leading	9.13	0.992	Leading	15.95	0.995	Leading	13.25
93	FLT118-3PH	0.999	Leading	5.83	0.994	Lagging	-14.79	0.997	Leading	9.65	0.992	Leading	16.20	0.994	Leading	13.89
94	FLT119-3PH	0.999	Leading	4.93	0.992	Lagging	-16.18	0.998	Leading	7.12	0.993	Leading	14.93	0.996	Leading	11.16
95	FLT120-3PH	0.998	Leading	8.92	0.995	Lagging	-12.41	0.996	Leading	11.52	0.990	Leading	18.26	0.993	Leading	15.66
96	FLT121-3PH	0.999	Leading	5.97	0.993	Lagging	-15.52	0.998	Leading	9.10	0.992	Leading	15.97	0.995	Leading	13.09
97	FLT126-3PH	0.996	Lagging	-11.33	0.972	Lagging	-31.11	0.999	Lagging	-6.39	1.000	Leading	1.23	0.990	Lagging	-18.10
98	FLT127-3PH	0.999	Leading	5.54	0.992	Lagging	-16.09	0.997	Leading	9.16	0.992	Leading	16.01	0.995	Leading	13.17
99	FLT128-3PH	0.999	Leading	5.77	0.993	Lagging	-15.43	0.997	Leading	9.57	0.992	Leading	16.19	0.995	Leading	13.15
100	FLT129-3PH	0.999	Leading	5.68	0.992	Lagging	-16.02	0.998	Leading	8.90	0.993	Leading	15.79	0.995	Leading	12.83

Study Generator GEN-2015-080

The Power Factor Analysis shows that GEN-2015-079 has a power factor range of 0.982 leading (absorbing) to 0.996 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.982 leading (absorbing) to 0.972 lagging (supplying) for the 2017 Summer Peak conditions, a power factor range of 0.982 leading (absorbing) to 0.999 lagging (supplying) to for the 2020 Summer Peak conditions, a power factor range of 0.985 leading (absorbing) to 1.00 (unity) for the 2020 Winter Peak conditions, and a power factor range of 0.958 leading (absorbing) to 0.990 lagging (supplying) for the 2025 Summer Peak conditions.

SECTION 6: LOW WIND/NO WIND ANALYSIS

The objective of this task was to determine the impact of low wind or no wind conditions/solar irradiance on wind farms and solar farms, respectively. The 2016 Winter Peak, 2017 Summer Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak power flows provided by SPP were examined for this analysis.

6.1 Approach

Low/no wind and low/no solar irradiance conditions were examined for all renewable interconnections. Generators were disabled (independently), but the collector systems remained in-service. In order to maintain generation and load balance in the SPP area, the generation was scaled after disabling the respective generator. The amount of reactive power injected into the transmission network was recorded at the respective point of interconnection. This reactive power comes from the capacitance of the project’s transmission lines and collector cables. A shunt reactor was added at the high side bus to bring the Mvar flow into the POI down to approximately zero.

6.2 Low Wind/No Wind Analysis Results

The reactance needed to bring the Mvar flow into the point of interconnect to zero Mvar was recorded for each season for renewable interconnections. Refer to Table 6-1 for the results of this analysis. The table lists the generators examined and the amount of reactive power needed for zero Mvar flow into the POI for each season.

Table 6-1
Low Wind/No Wind Analysis

Request	Size (MW)	Point of Interconnection	Reactor Size (Mvar)				
			16WP	17SP	20SP	20WP	25SP
GEN-2015-020	100	Oasis 115kV	0.7	0.7	0.7	0.7	0.7
GEN-2015-031	150.53	Swisher to Amarillo South 230 kV	8.1	8.1	8.1	8.1	8.1
GEN-2015-056	101	Crossroads 345kV	8.6	8.6	8.6	8.6	8.6
GEN-2015-058	50	Atoka 115kV	0.4	0.4	0.4	0.4	0.4
GEN-2015-068	300	Tuco 345kV	58.0	58.0	58.0	58.0	58.0
GEN-2015-075	50	Carlisle 69kV	4.0	4.0	4.0	4.0	4.0
GEN-2015-079	129.2	Tap Yoakum to Hobbs 230 kV	1.0	1.0	1.0	1.0	1.0
GEN-2015-080	129.2	Tap Yoakum to Hobbs 230 kV	1.0	1.0	1.0	1.0	1.0

SECTION 7: CONCLUSIONS

Summary of Stability Analysis

The Stability Analysis determined that there were multiple contingencies across all seasons that resulted in system/voltage instability, generation tripping offline, and poor post-fault voltage recovery when all generation interconnection requests were at 100% output.

To mitigate the system/voltage instability, voltage violations, generation tripping offline, and poor post-fault steady-state voltages, the following upgrades were provided by SPP and implemented in each season:

- OKU Reactive Power Support
    - 2x50 Mvar switched shunts
- Crawfish Draw Substation
    - Tap Tuco – Border 345 kV
    - Tap Tuco – Swisher 230 kV
    - Crawfish Draw 345/230 kV transformer
- Tuco – Crawfish Draw – Border 345 kV circuit #2
    - Reroute Yoakum – Tuco to Yoakum – Crawfish Draw
- Border – Chisholm 345 kV circuit #1 and #2

After implementing the above upgrades, the contingency analysis was re-simulated for all contingencies. With the upgrades, the Stability Analysis determined that there was no wind turbine tripping or system instability observed as a result of interconnecting all study projects at 100% output.

Summary of the Short Circuit Analysis

The short circuit analysis was performed on the 2017 Summer Peak and 2025 Summer Peak power flows for all study projects. Refer to Table 7-1 and Table 7-2 for a list of maximum fault currents observed for each study project for the 17SP and 25SP cases, respectively.

Table 7-1
2017SP: List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-020	9.37	25.46	Tolk East/West	230
GEN-2015-031	8.94	30.45	Nichols	115
GEN-2015-056	4.87	24.33	Cunningham	115
GEN-2015-058	5.94	24.33	Cunningham	115
GEN-2015-068	10.63	30.41	LP - Cook	69
GEN-2015-075	2.56	25.46	Tolk East	230
GEN-2015-079	8.26	28.22	Hobbs Int	115
GEN-2015-080	8.26	28.22	Hobbs Int	115

Table 7-2
2025SP: List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-020	9.49	26.25	Tolk East/West	230
GEN-2015-031	9.05	34.93	LP - Cook	69
GEN-2015-056	5.47	29.30	Cunningham	115
GEN-2015-058	6.95	29.30	Cunningham	115
GEN-2015-068	12.82	34.93	LP - Cook	69
GEN-2015-075	2.57	26.25	Tolk East	230
GEN-2015-079	8.96	32.45	Hobbs Int	115
GEN-2015-080	8.96	32.45	Hobbs Int	115

Summary of Power Factor Analysis

The upgrades identified in the Stability Analysis were implemented in the power flow cases and utilized for the Power Factor Analysis. Refer to Table 7-3 for the power factor range observed for each study project.

Table 7-3
Summary of Results for the Power Factory Analysis

	Power Factor Range for Each Study Project[1]									
Study Project	16WP		17SP		20SP		20WP		25SP	
GEN-2015-020	-0.991	0.973	-0.999	0.974	0.977	1.000	-0.997	0.977	-0.999	0.974
GEN-2015-031	-0.834	0.975	-0.853	0.999	-0.956	0.980	-0.966	0.999	-0.942	0.987
GEN-2015-056	-0.970	0.999	-0.983	1.000	-0.988	0.999	-0.978	0.999	-0.986	0.999
GEN-2015-058	-0.940	0.971	-0.947	0.975	-0.999	0.976	-0.992	0.990	-0.969	0.972
GEN-2015-068	-0.737	-0.891	-0.889	-0.984	-0.960	1.000	-0.914	-0.995	-0.976	1.000
GEN-2015-075	0.986	1.000	0.994	1.000	-0.994	1.000	0.996	1.000	0.990	1.000
GEN-2015-079	-0.996	0.982	-0.972	0.982	-0.999	0.982	0.985	1.000	-0.990	0.958
GEN-2015-080	-0.996	0.982	-0.972	0.982	-0.999	0.982	0.985	1.000	-0.990	0.958

[1] Lagging power factors are negative and leading power factors are positive

Summary of the Low/No Wind Analysis

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for each wind and solar powered interconnection request for each season. The maximum reactance needed for zero Mvar flow was 58 Mvar for GEN-2015-068 (Tuco 345 kV). The minimum reactance needed for zero Mvar flow was 0.4 Mvar for GEN-2015-058 (Atoka 115 kV).

11.14 K: Transient Stability Group 8

See next page.

Group 8 Stability Impact Study

DISIS-2015-002-4

September 2017
Generator Interconnection

Southwest Power Pool

Revision History

Date	Author	Change Description
9/22/2017	SPP	DISIS-2015-002-4 Group 8 Stability Report Issued

Executive Summary

DISIS-2015-002-4 Group 8 Interconnection Customers have requested a Definitive Interconnection System Impact Study detailing the impacts of interconnecting the generation projects shown below.

- GEN-2015-034 – 200.0 MW wind generation facility using one hundred (100) Vestes V112-2MW wind generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at the existing Ranch Road 345 kV station.
- GEN-2015-047 – 300.0 MW wind generation facility using one hundred fifty (150) Vestas V110 2.0 MW wind turbine generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at the existing Sooner 345 kV station.
- GEN-2015-052 – 300.0 MW wind generation facility using one hundred fifty (150) Vestas V110 2.0 MW wind turbine generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at a tap on the Open Sky to Rosehill 345 kV line.
- GEN-2015-062 – 4.5 MW uprate to wind generation facility (GEN-2012-033) using fifty-three (53) GE 1.8MW and four (4) GE 1.79MW wind turbine generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at the existing Breckenridge 138 kV station. Total power becomes 102.6MW.
- GEN-2015-063 – 300.0 MW wind generation facility using one hundred fifty (150) Vestas V110 2.0 MW wind turbine generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at a tap on the Woodring to Matthewson 345 kV line.
- GEN-2015-066 – 248.4 MW wind generation facility using one hundred eight (108) GE 2.3 MW wind turbine generators interconnecting to the Oklahoma Gas and Electric (OKGE) transmission system at a tap on the Cleveland to Sooner 345 kV line.
- GEN-2015-069 – 300.0 MW wind generation facility using one hundred fifty (150) Vestas V110 2.0 MW wind turbine generators interconnecting to the Westar (WERE) transmission system at the existing Union Ridge 230 kV station.
- GEN-2015-073 – 200.1 MW wind generation facility using eighty-seven (87) Siemens 2.3 MW wind turbine generators interconnecting to the Westar (WERE) transmission system at the existing Emporia/Lang 345kV station.
- GEN-2015-083 – 125 MW wind generation facility using fifty-four (54) GE 2.3 MW wind turbine generators interconnecting to the Westar (WERE) transmission system at the existing Belle Plain 138 kV station.
- GEN-2015-090 – 220 MW wind generation facility using one hundred ten (110) GE 2 MW wind turbine generators interconnecting to the Westar (WERE) transmission system at a tap on the Wichita to Thistle 345kV line.

A stability cluster impact analysis was performed for the generation project from the DISIS-2015-002-4 Group 8 study. The analysis was performed on three (3) seasonal models including 2016 winter peak (16WP), the 2017 summer peak (17SP), and the 2025 summer peak (25SP) cases. These cases are modified versions of the 2015 model series of Model Development Working Group (MDWG) dynamic study models. A total of one hundred sixteen (116) contingencies were evaluated for the three (3) seasonal cases.

Stability analysis has determined with all previously assigned Network Upgrades in service, all generators in the monitored areas remained stable and within the pre-contingency, voltage recovery, and post fault voltage recovery criterion of 0.7pu to 1.2pu for the entire modeled disturbances. Under certain system conditions the interconnection requests may be required to curtail generation output to maintain system reliability.

Power factor analysis for each generation project was performed on the current study 2016 winter peak, 2017 summer peak, and 2025 summer peak cases with identified system upgrades. As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

A reduced generation analysis was conducted for wind farms to determine reactor inductive amounts to compensate the capacitive effects on the transmission system during low or reduced wind conditions cause by the interconnecting project's generator lead transmission line and collector systems. Each request may be required to install the following reactors on their facilities: GEN-2015-034 – 11.7 Mvar, GEN-2015-047 – 37.4 Mvar, GEN-2015-052 – 23.5 Mvar, GEN-2015-062 – 4.6 Mvar, GEN-2015-063 – 15.2 Mvar, GEN-2015-066 – 13 Mvar, GEN-2015-069 – 27.9 Mvar, GEN-2015-073 – 14.5 Mvar, GEN-2015-083 – 8.7 Mvar, and GEN-2015-090 – 10 Mvar .

Short Circuit analysis was conducted using the current study upgrade 2017 summer peak and 2025 summer peak cases.

Nothing in this study should be construed as a guarantee of delivery or transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the Customer.

Table of Contents

1. Introduction

DISIS-2015-002-4 Group 8 Interconnection Customers have requested a Definitive Interconnection System Impact Study detailing the impacts of interconnecting the generation projects shown **Table 1-1** below.

Table 1-1: Group 8 Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2015-034	200	Vestas V112- 2MW (wind)	Ranch Road 345kV (515576)
GEN-2015-047	300	Vestas V110-2MW (wind)	Sooner 345kV Tap (514803)
GEN-2015-052	300	Vestas V110-2MW (wind)	Tap on Opensky (515621) to RoseHill (532794) 345 kV (560053)
GEN-2015-062	4.5 (uprate to GEN-2012-033)	GE 1.79MW (wind)	Breckenridge 138kV (514815)
GEN-2015-063	300	Vestas V110-2MW (wind)	Tap on Woodring (514715) to Matthewson (515497) 345 kV (560055)
GEN-2015-066	248.4	GE 2.3MW (wind)	Tap on Cleveland (512694) to Sooner (514803) 345 kV (560056)
GEN-2015-069	300	Vestas V110-2MW (wind)	Union Ridge 230kV (532874)
GEN-2015-073	200.1	Siemens 2.3MW (wind)	Emporia/Lang 345kV (532768)
GEN-2015-083	125	GE 2.3MW (wind)	Belle Plain 138kV (533063)
GEN-2015-090	220	GE 2MW (wind)	Wichita (532796)-Thistle (539801) 345kV Tap (GEN-2015-024 (560033) 345kV)

The previously queued generation projects in the Group 8 area are listed in **Table 1-2** below.

Table 1-2: Prior Queued Projects

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2002-004	199.5	GE.1.5MW	Latham 345kV (532800)
GEN-2005-013	199.8	Vestas V90 1.8MW	Caney River 345kV (532780)
GEN-2007-025	299.2	GE 1.6MW	Viola 345kV (532798)
GEN-2008-013	300	GE 1.68MW	Hunter 345kV (515476)
GEN-2008-021	1261 Summer 1283 Winter	GENROU	Wolf Creek 345kV (532797)
GEN-2008-098	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)
GEN-2009-025	59.8	Siemens 2.3MW	Tap on the Deerck – Sincblk 69KV line (515528)
GEN-2010-003	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)
GEN-2010-005	299.2	GE 1.6MW	Viola 345kV (532798)
ASGI-2010-006	150	GE1.5MW	Remington 138kV (301369)
GEN-2010-055	4.8	GENROU	Wekiwa 138kV (509757)
GEN-2011-057	150.4	GE 1.6MW	Creswell 138kV (532981)

Request	Size (MW)	Generator Model	Point of Interconnection
KCPL Distributed: Osawatomie	76.0	GENROU (543078)	Paola 161kV
GEN-2012-032	300	Vestas V112 3.0MW	Tap Rose Hill-Sooner 345kV (562318)
GEN-2012-033	98.8	GE 1.62MW	Tap Bunch Creek-South 4th 138kV(562303)
GEN-2012-041	85 Summer 121.5 Winter	GENROU	Tap Rose Hill-Sooner 345kV (562318)
GEN-2013-012	4 x 168.0MW Summer 4 x 215MW Winter	GENROU (514910) (514911) (514912) (514942)	Redbud 345kV (514909)
GEN-2013-028	516.4 Summer 559.5 Winter	GENROU (583743, 583746)	Tap on Tulsa N to GRDA1 345kV (562423)
GEN-2013-029	300	Vestas V100 VCSS 2MW (583753, 583756)	Renfrow 345kV(515543)
GEN-2014-001	200.6	GE 1.7MW 100m (583853,583856)	Tap Wichita to Emporia Energy Center 345kV (562476)
GEN-2014-028	35 (Uprate) (Pgen=259W/256S)	GENROU	Riverton 161kV (547469)
GEN-2014-064	248.4	GE 2.3MW	Otter 138kV (514708)
ASGI-2014-014	56.4W/54.3S	GENROU	Ferguson 69kV (512664)
GEN-2015-001	200.0	Vestas V110 2.0MW	Ranch Road 345kV
GEN-2015-015	154.6	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Tap Medford Tap – Coyote 138kV
GEN-2015-016	200.0	Vestas V110 2.0MW	Tap Centerville – Marmaton 161kV
GEN-2015-024	220.0	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-025	220.0	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-030	200.1	GE 2.3MW	Sooner 345kV
ASGI-2015-004	54.300 Summer 56.364 Winter	GENSAL	Coffeyville Municipal Light & Power Northern Industrial Park Substation 69kV (512735)

A stability analysis was performed for the addition of the generation projects in Group 8. The analysis was performed on three (3) seasonal models including 2016 winter peak (16WP), the 2017 summer peak (17SP), and the 2025 summer peak (25SP) cases. These cases are modified versions of the 2015 model series of Model Development Working Group (MDWG) dynamic study models.

The stability analysis determines the impacts of the new interconnecting project on the stability and voltage recovery of the nearby systems and the ability of the interconnecting project to meet FERC Order 661A. If problems with stability or voltage recovery are identified, the need for reactive compensation or system upgrades is investigated. The contingencies listed in **Table 3-1** were used in the stability analysis.

The power factor analysis determines the power factor at the point of interconnection (POI) for the wind interconnection projects for pre-contingency and post-contingency conditions. The contingencies used in the power factor analysis are a subset of the stability analysis contingencies shown in **Table 3-1**.

A reduced generation analysis was conducted for wind farms to determine reactor inductive amounts to compensate the capacitive effects on the transmission system during low or reduced wind conditions cause by the interconnecting project's generator lead transmission line and collector systems. **Table 5-1** displays the minimum reactor inductive amount requirement to compensate capacitive effects from the GEN-2015-034, GEN-2015-047, GEN-2015-052, GEN-2015-062, GEN-2015-063, GEN-2015-066, GEN-2015-069, GEN-2015-073, GEN-2015-083, & GEN-2015-090 facilities.

Short Circuit analysis was conducted using the current study upgrade 2017 summer peak and 2025 summer peak cases. The results from the Short circuit analysis are show in Appendix F.

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer any rights to transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the Customer.

2. Facilities

A one-line PSS/E slider drawings from the 16WP case for each of the generation interconnection requests in this study is shown in Figure 2-1 through 2-10.

Figure 2-1: GEN-2015-034 One-line Diagram

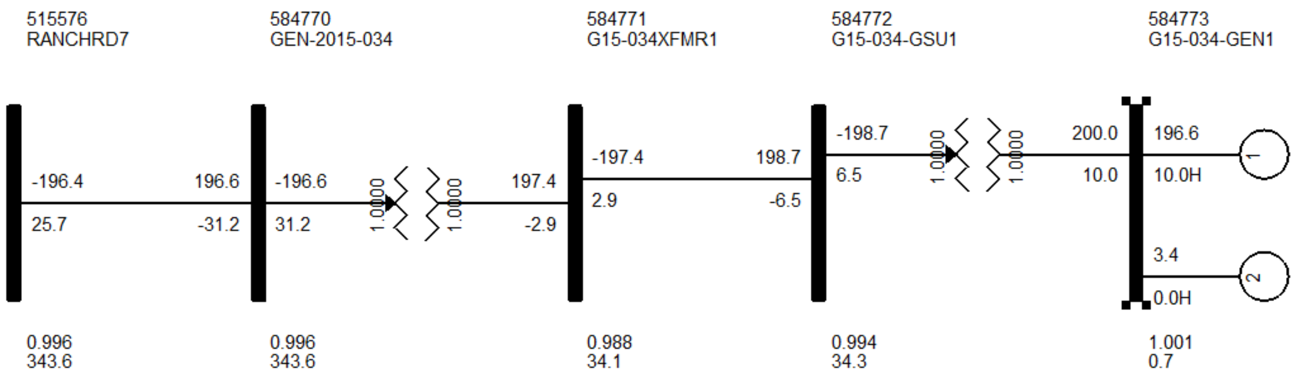


Figure 2-2: GEN-2015-047 One-line Diagram

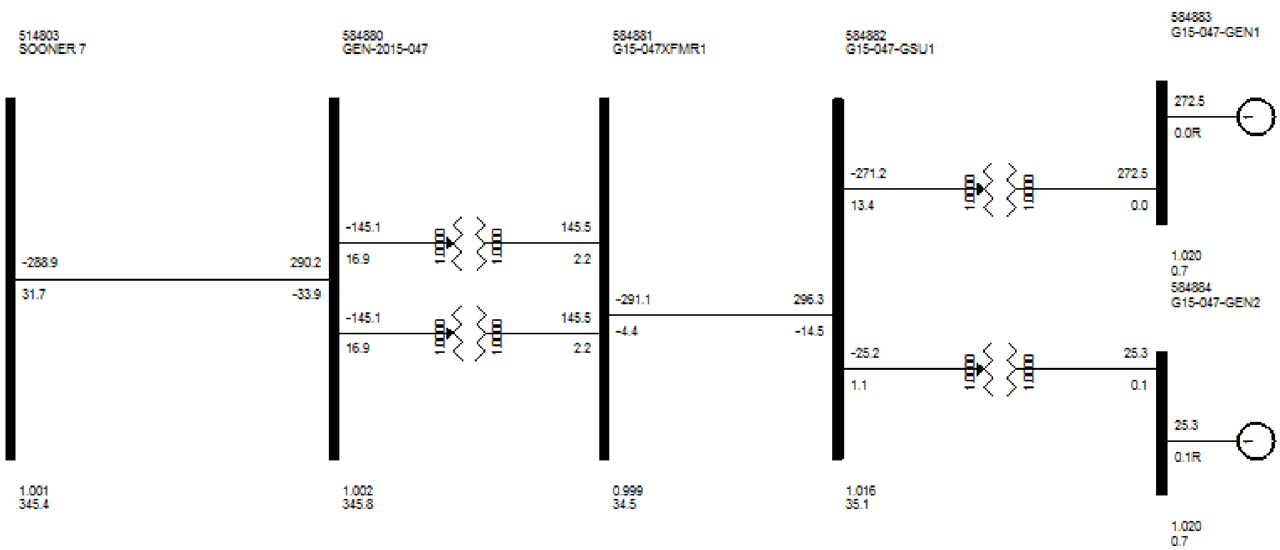


Figure 2-3: GEN-2015-052 One-line Diagram

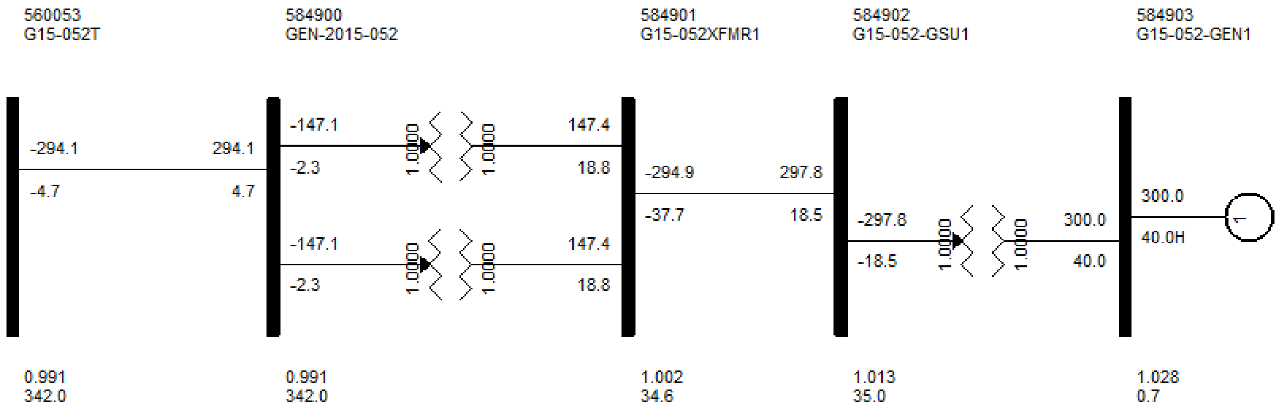


Figure 2-4: GEN-2015-62 One-line Diagram

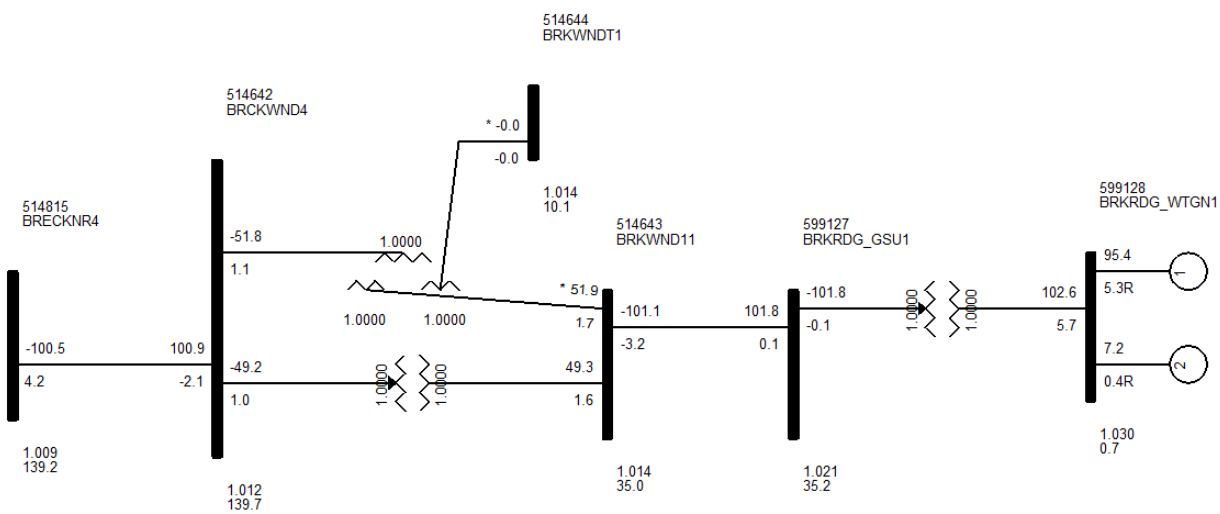


Figure 2-5: GEN-2015-063 One-line Diagram

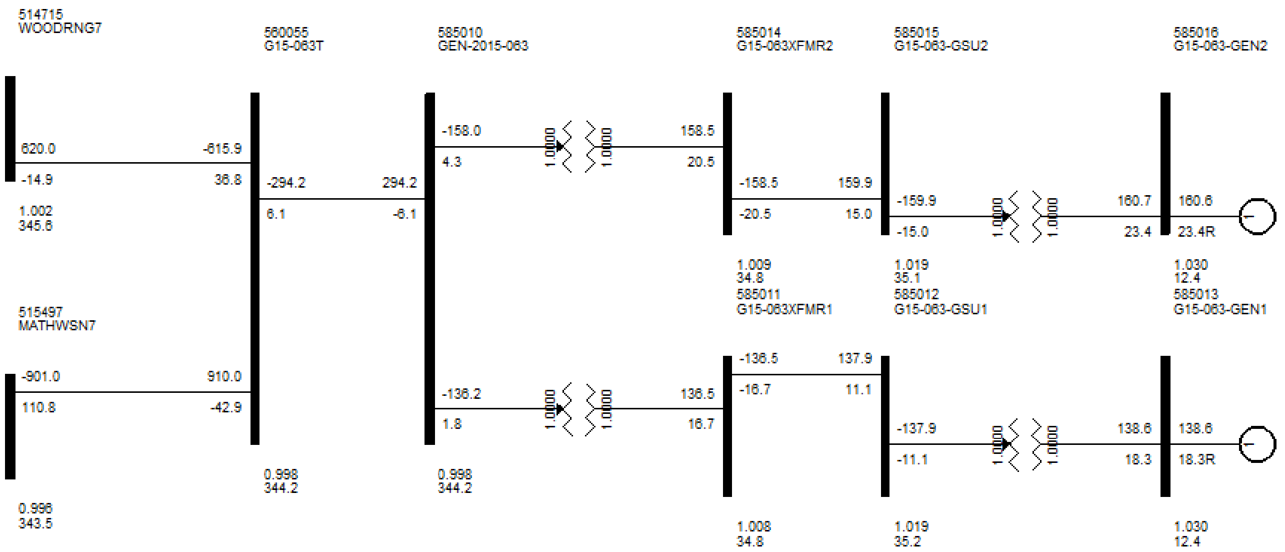


Figure 2-6: GEN-2015-066 One-line Diagram

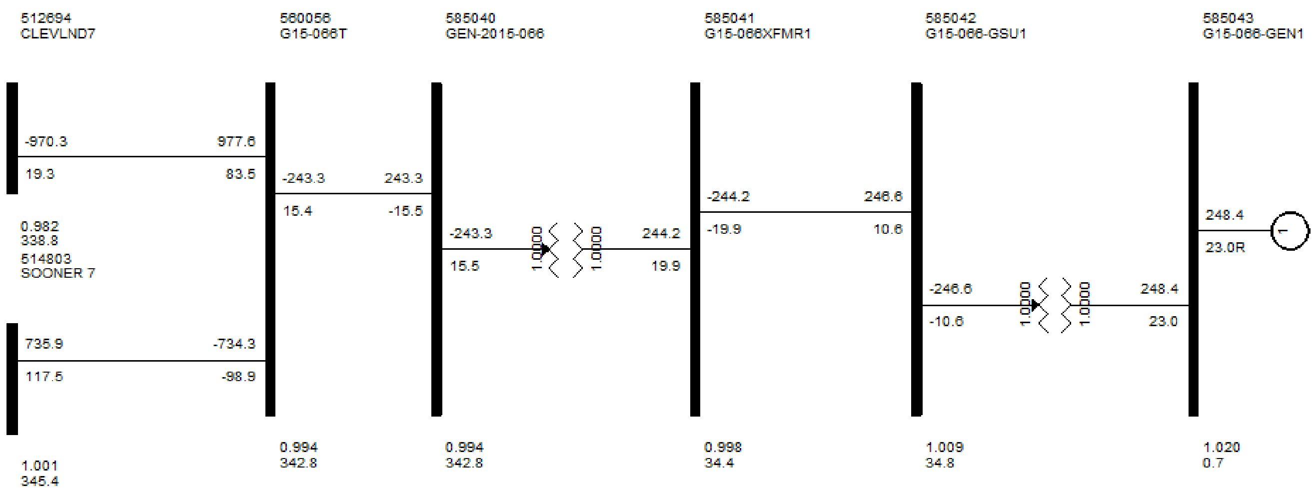


Figure 2-7*:* GEN-2015-069 One-line Diagram

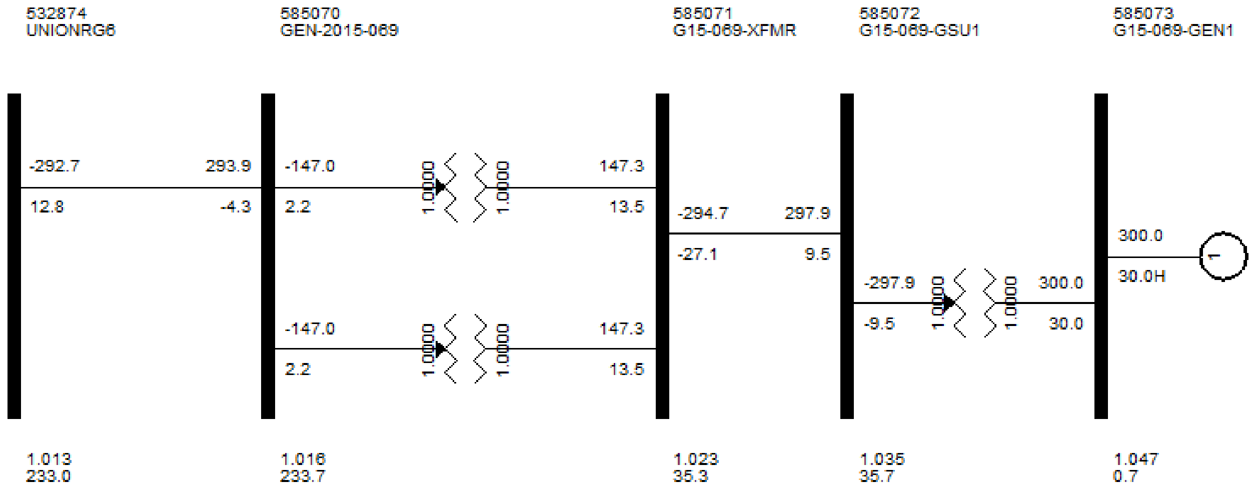


Figure 2-8*:* GEN-2015-073 One-line Diagram

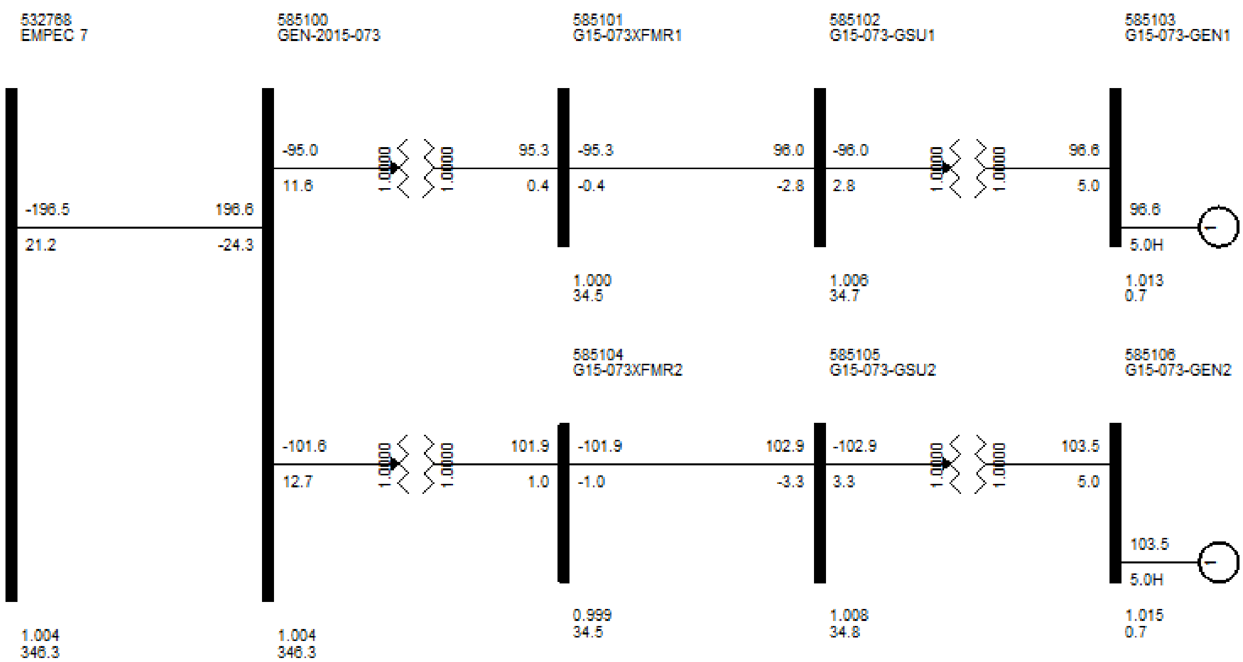


Figure 2-9: GEN-2015-083 One-line Diagram

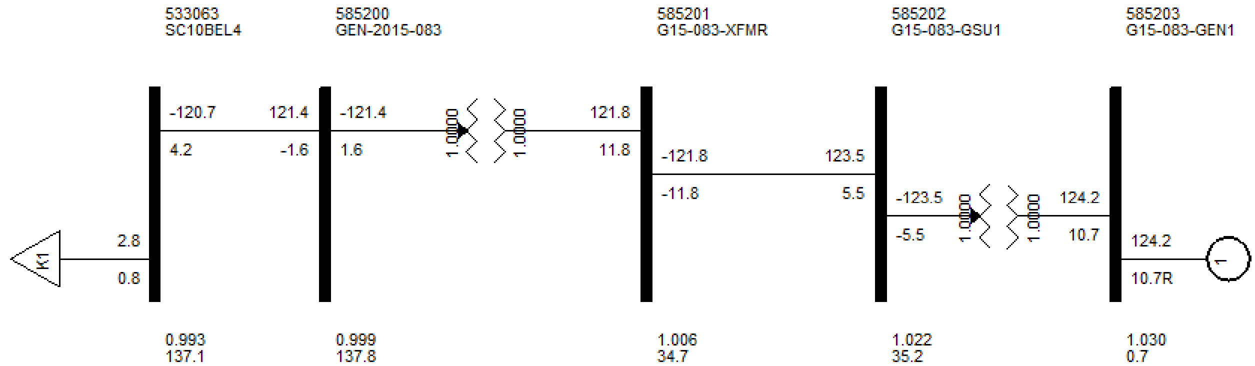
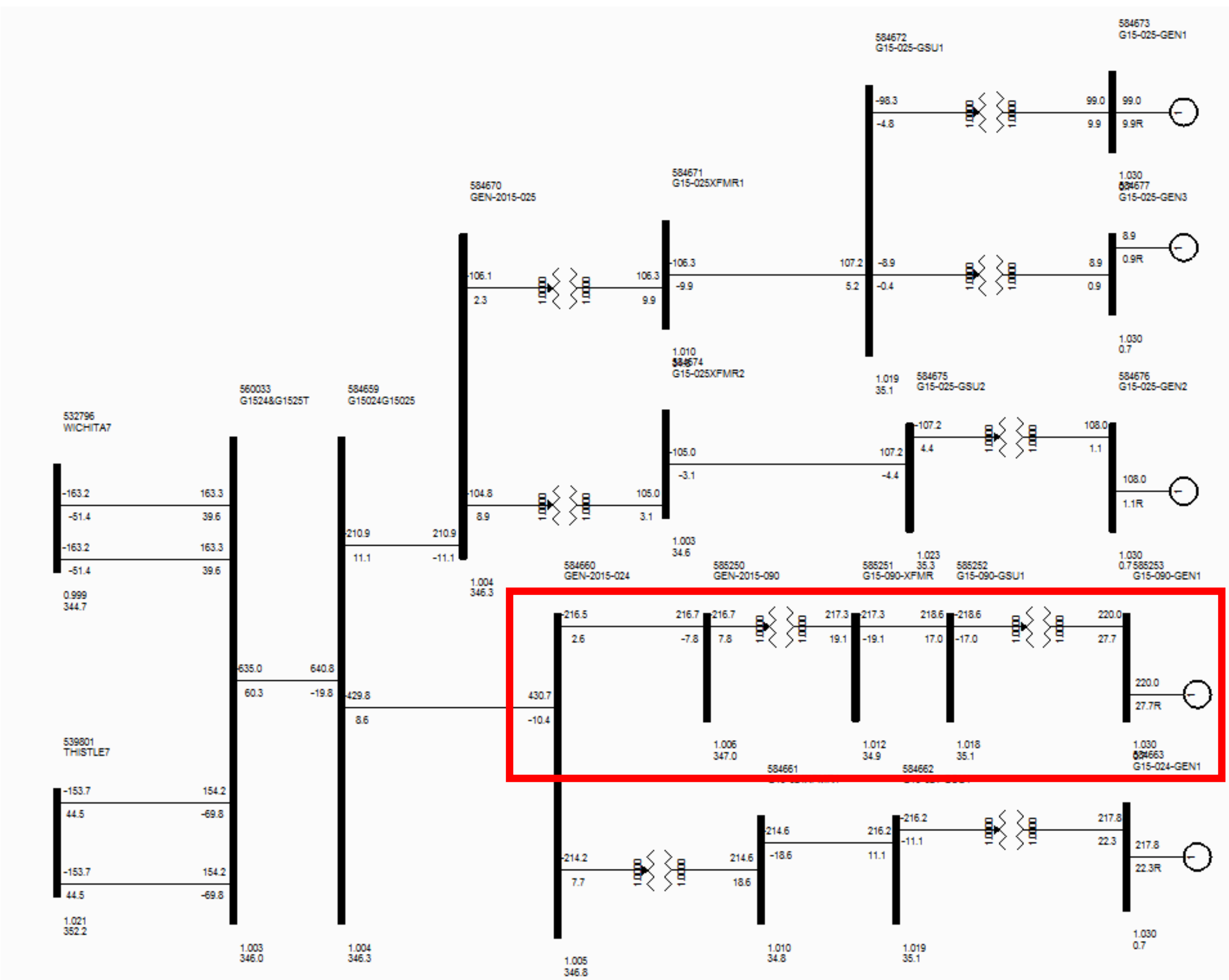


Figure 2-10: GEN-2015-090 One-line Diagram



3. Stability Analysis

Transient stability analysis is used to determine if the transmission system can maintain angular stability and ensure bus voltages stay within planning criteria bandwidth during and after a disturbance while considering the addition of a generator interconnection request.

Model Preparation

Transient stability analysis was performed using modified versions of the 2015 series of Model Development Working Group (MDWG) dynamic study models including the 2016 winter peak, 2017 summer peak, and the 2025 summer peak seasonal models. The cases are then loaded with prior queued interconnection requests and network upgrades assigned to those interconnection requests. Finally the prior queued and study generation are dispatched into the SPP footprint. Initial simulations are then carried out for a no-disturbance run of twenty (20) seconds to verify the numerical stability of the model.

Disturbances

One hundred sixteen (116) contingencies were identified for use in this study and are listed in **Table 3-1**. These contingencies are faults at locations defined by SPP Generation Interconnection Staff. These contingencies include three-phase N-1, single-phase stuck breaker, and three-phase prior outage faults. Single-phase line faults were simulated by applying fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

Except for transformer faults, the typical sequence of events for a three-phase fault is as follows:

1. apply fault at particular location
2. continue fault for five (5) cycles, clear the fault by tripping the faulted facility
3. after an additional twenty (20) cycles, re-close the previous facility back into the fault
4. continue fault for five (5) additional cycles
5. trip the faulted facility and remove the fault

Transformer faults are typically modeled as three-phase faults, unless otherwise noted. The sequence of events for a transformer fault is as follows:

1. apply fault for five (5) cycles
2. clear the fault by tripping the affected transformer facility (unless otherwise noted there will be no re-closing into a transformer fault)

The SPP areas monitored during the stability analysis were:

- 330: Associated Electric Cooperative(AECI)
- 515: Southwestern Power Administration (SWPA)
- 523: Grand River Dam Authority (GRDA)
- 520: American Electric Power (AEPW)
- 524: Oklahoma Gas and Electric Company (OKGE)
- 525: Western Farmers Electric Cooperative (WFEC)
- 526: Southwestern Public Service (SPS)
- 527: Oklahoma Municipal Power Authority (OMPA)
- 531: Midwest Energy, Inc. (MIDW)
- 534: Sunflower Electric Power Corp. (SUNC)
- 536: Westar Energy, Inc. (WERE)
- 540:Greater Missouri Operations (GMO)
- 541: Kansas City Power & Light (KCPL)
- 542: Kansas City Board of Public Utilities (KACY)
- 544: Empire District Electric (EMDE)
- 640: Nebraska Public Power District (NPPD)

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
0	FLT_000_NOFAULT	No Fault Conditions
1	FLT_01_RANCHRD7_OPENSKY7_345kV_3PH	3 phase fault on the RANCHRD7 (515576) to OPENSKY7 (515621) 345 kV line circuit 1, near RANCHRD7. a. Apply fault at the RANCHRD7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT_02_RANCHRD7_SOONER7_345kV_3PH	3 phase fault on the RANCHRD7 (515576) to SOONER 7 (514803) 345 kV line circuit 1, near RANCHRD7. a. Apply fault at the RANCHRD7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT_03_OPENSKY7_G15052_345kV_3PH	3 phase fault on the OPENSKY7 (515621) to G15052 (560053) 345 kV line circuit 1, near OPENSKY7. a. Apply fault at the OPENSKY7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT_04_SOONER7_G16061TAP_345kV_3PH	3 phase fault on the SOONER 7 (514803) to G16061 Tap (560084) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT_05_G16061TAP_WOODRNG7_345kV_3PH	3 phase fault on the G16061 Tap (560084) to WOODRNG7 (514715) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT_06_SOONER7_G15066_345kV_3PH	3 phase fault on the SOONER 7 (514803) to G15066 (560056) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
7	FLT_07_SOONER7_SOONER4_345_138kV_3PH	3 phase fault on the SOONER 7 (514803) 345 kV /(514802) 138 kV /(515760) 13.8 kV transformer, near SOONER 7 345 kV. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
8	FLT_08_SOONER7_SPRNGCK7_345kV_3PH	3 phase fault on the SOONER 7 (514803) to SPRNGCK7 (514881) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
9	FLT_09_G1524G1525T_THISTLE7_345kV_3PH	3 phase fault on the G1524&G1525T (560033) to THISTLE7 (539801) 345 kV line circuit 1, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT_10_G1524G1525T_WICHITA7_345kV_3PH	3 phase fault on the G1524&G1525T (560033) to WICHITA7 (532796) 345 kV line circuit 1, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
11	FLT_11_THISTLE7_G16005TAP_345kV_3PH	3 phase fault on the THISTLE7 (539801) to G16005 Tap (560072) 345 kV line circuit 1, near THISTLE7. a. Apply fault at the THISTLE7 (539801) 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV_3PH	3 phase fault on the G16005 Tap (560072) to CLARKCOUNTY7 (539800) 345 kV line circuit 1, near THISTLE7. a. Apply fault at the THISTLE7 (539801) 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
13	FLT_13_THISTLE7_WWRDEHV7_345kV_3PH	3 phase fault on the THISTLE7 (539801) to WWRDEHV7 (515375) 345 kV line circuit 1, near THISTLE7 (539801). a. Apply fault at the THISTLE7 (539801) 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT_14_THISTLE7_THISTLE4_345_138kV_3PH	3 phase fault on the THISTLE7 (539801) 345 kV /(539804) 138 kV /(539802) 13.8 kV transformer, near THISTLE7 345 kV. a. Apply fault at the THISTLE7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
15	FLT_15_WICHITA7_VIOLA7_345kV_3PH	3 phase fault on the WICHITA7 (532796) to VIOLA 7 (532798) 345 kV line circuit 1, near WICHITA7. a. Apply fault at the WICHITA7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT_16_WICHITA7_RENO7_345kV_3PH	3 phase fault on the WICHITA7 (532796) to RENO 7 (532771) 345 kV line circuit 1, near WICHITA7. a. Apply fault at the WICHITA7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
17	FLT_17_WICHITA7_BENTON7_345kV_3PH	3 phase fault on the WICHITA7 (532796) to BENTON 7 (532791) 345 kV line circuit 1, near WICHITA7. a. Apply fault at the WICHITA7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT_18_WICHITA7_G14001TAP_345kV_3PH	3 phase fault on the WICHITA7 (532796) to G14-001-TAP (562476) 345 kV line circuit 1, near WICHITA7. a. Apply fault at the WICHITA7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
19	FLT_19_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on the WICHITA7 (532796) 345 kV / (533040) 138 kV / (532829) 13.8 kV transformer, near WICHITA7 345 kV. a. Apply fault at the WICHITA7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
20	FLT_20_WOODRNG7_G15063_345kV_3PH	3 phase fault on the WOODRNG7 (514715) to G15063 (560055) 345 kV line circuit 1, near WOODRNG7. a. Apply fault at the WOODRNG7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT_21_WOODRNG7_HUNTERS7_345kV_3PH	3 phase fault on the WOODRNG7 (514715) to HUNTERS7 (515476) 345 kV line circuit 1, near WOODRNG7. a. Apply fault at the WOODRNG7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on the WOODRNG7 (514715) 345 kV / (514714) 138 kV / (515770) 13.8 kV transformer, near WOODRNG7 345 kV. a. Apply fault at the WOODRNG7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
23	FLT_23_SOONER4_SNRPMPT4_138kV_3PH	3 phase fault on the SOONER 4 (514802) to SNRPMPT4 (514798) 138 kV line circuit 1, near SOONER 4. a. Apply fault at the SOONER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT_24_SOONER4_PERRY4_138kV_3PH	3 phase fault on the SOONER 4 (514802) to PERRY 4 (514707) 138 kV line circuit 1, near SOONER 4. a. Apply fault at the SOONER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT_25_SOONER4_MILLERT4_138kV_3PH	3 phase fault on the SOONER 4 (514802) to MILLERT4 (514704) 138 kV line circuit 1, near SOONER 4. a. Apply fault at the SOONER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
26	FLT_26_SOONER4_MORISNT4_138kV_3PH	3 phase fault on the SOONER 4 (514802) to MORISNT4 (515447) 138 kV line circuit 1, near SOONER 4. a. Apply fault at the SOONER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT_27_SPRNGCK7_NORTWST7_345kV_3PH	3 phase fault on the SPRNGCK7 (514881) to NORTWST7 (514880) 345 kV line circuit 1, near SPRNGCK7. a. Apply fault at the SPRNGCK7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT_28_G15066_CLEVLND7_345kV_3PH	3 phase fault on the G15066 (560056) to CLEVLND7 (512694) 345 kV line circuit 1, near G15066. a. Apply fault at the G15066 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
29	FLT_29_G15052_ROSEHIL7_345kV_3PH	3 phase fault on the G15052 (560053) to ROSEHIL7 (532794) 345 kV line circuit 1, near G15052. a. Apply fault at the G15052 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV_3PH	3 phase fault on the ROSEHIL7 (532794) 345 kV / (533062) 138 kV /(532826) 13.8 kV transformer, near ROSEHIL7 345 kV. a. Apply fault at the ROSEHIL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
31	FLT_31_ROSEHIL7_BENTON7_345kV_3PH	3 phase fault on the ROSEHIL7 (532794) to BENTON 7 (532791) 345 kV line circuit 1, near ROSEHIL7. a. Apply fault at the ROSEHIL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV_3PH	3 phase fault on the ROSEHIL7 (532794) to WOLFCRK7 (532797) 345 kV line circuit 1, near ROSEHIL7. a. Apply fault at the ROSEHIL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
33	FLT_33_ROSEHIL7_LATHAMS7_345kV_3PH	3 phase fault on the ROSEHIL7 (532794) to LATHAMS7 (532800) 345 kV line circuit 1, near ROSEHIL7. a. Apply fault at the ROSEHIL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT_34_BRECKNR4_SO4TH4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to SO4TH 4 (514731) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
35	FLT_35_BRECKNR4_BUNCHCK4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
36	FLT_36_BRECKNR4_ENIDINT4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to ENIDINT4 (515383) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT_37_BRECKNR4_PLNSMEN4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to PLNSMEN4 (515641) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38	FLT_38_SO4TH4_SO4TH2_138_69kV_3PH	3 phase fault on the SO4TH 4 (514731) 138 kV / (514730) 69 kV /(515758) 13.2 kV transformer, near SO4TH 4 138 kV. a. Apply fault at the SO4TH 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
39	FLT_39_SO4TH4_IMO4_138kV_3PH	3 phase fault on the SO4TH 4 (514731) to IMO 4 (514790) 138 kV line circuit 1, near SO4TH 4. a. Apply fault at the SO4TH 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT_40_SO4TH4_WAUKOTP4_138kV_3PH	3 phase fault on the SO4TH 4 (514731) to WAUKOTP4 (514711) 138 kV line circuit 1, near SO4TH 4. a. Apply fault at the SO4TH 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT_41_SO4TH4_FRMNTAP4_138kV_3PH	3 phase fault on the SO4TH 4 (514731) to FRMNTAP4 (514709) 138 kV line circuit 1, near SO4TH 4. a. Apply fault at the SO4TH 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV_3PH	3 phase fault on the BUNCHCK4 (514701) to BLLNGTP4 (515635) 138 kV line circuit 1, near BUNCHCK4. a. Apply fault at the BUNCHCK4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
43	FLT_43_ENIDINT4_NRTHSTR4_138kV_3PH	3 phase fault on the ENIDINT4 (515383) to NRTHSTR4 (515552) 138 kV line circuit 1, near ENIDINT4. a. Apply fault at the ENIDINT4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT_44_PLNSMEN4_FAIRMON4_138kV_3PH	3 phase fault on the PLNSMEN4 (515641) to FAIRMON4 (514712) 138 kV line circuit 1, near PLNSMEN4. a. Apply fault at the PLNSMEN4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
45	FLT_45_G15063_MATHWSN7_345kV_3PH	3 phase fault on the G15063 (560055) to MATHWSN7 (515497) 345 kV line circuit 1, near G15063. a. Apply fault at the G15063 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
46	FLT_46_MATHWSN7_CIMARON7_345kV_3PH	3 phase fault on the MATHWSN7 (515497) to CIMARON7 (514901) 345 kV line circuit 1, near MATHWSN7. a. Apply fault at the MATHWSN7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT_47_CLEVLND7_TNO7_345kV_3PH	3 phase fault on the CLEVLND7 (512694) to T.NO.--7 (509852) 345 kV line circuit 1, near CLEVLND7. a. Apply fault at the CLEVLND7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV_3PH	3 phase fault on the CLEVLND7 (512694) 345 kV / (512729) 138 kV /(512817) 13.8 kV transformer, near CLEVLND7 345 kV. a. Apply fault at the CLEVLND7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
49	FLT_49_UNIONRG6_SUMMIT6_230kV_3PH	3 phase fault on the UNIONRG6 (532874) to SUMMIT 6 (532873) 230 kV line circuit 1, near UNIONRG6. a. Apply fault at the UNIONRG6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
50	FLT_50_UNIONRG6_MORRIS6_230kV_3PH	3 phase fault on the UNIONRG6 (532874) to MORRIS 6 (532863) 230 kV line circuit 1, near UNIONRG6. a. Apply fault at the UNIONRG6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
51	FLT_51_SUMMIT6_MCPHER6_230kV_3PH	3 phase fault on the SUMMIT 6 (532873) to EMCPHER6 (532872) 230 kV line circuit 1, near SUMMIT 6. a. Apply fault at the SUMMIT 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
52	FLT_52_SUMMIT6_SMOKYHL6_230kV_3PH	3 phase fault on the SUMMIT 6 (532873) to SMOKYHL6 (530592) 230 kV line circuit 1, near SUMMIT 6. a. Apply fault at the SUMMIT 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV_3PH	3 phase fault on the SUMMIT 6 (532873) 230 kV/ (532773) 345 kV /(532813) 14.4 kV transformer, near SUMMIT 6 230 kV. a. Apply fault at the SUMMIT 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV_3PH	3 phase fault on the SUMMIT 6 (532873) 230 kV / (533381) 115 kV / (532897) 13.8 kV transformer, near SUMMIT 6 230 kV. a. Apply fault at the SUMMIT 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
55	FLT_55_MORRIS6_MCDOWEL6_230kV_3PH	3 phase fault on the MORRIS 6 (532863) to MCDOWEL6 (532862) 230 kV line circuit 1, near MORRIS 6. a. Apply fault at the MORRIS 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
56	FLT_56_MORRIS6_SWISVAL6_230kV_3PH	3 phase fault on the MORRIS 6 (532863) to SWISVAL6 (532856) 230 kV line circuit 1, near SWISVAL6. a. Apply fault at the SWISVAL6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
57	FLT_57_MORRIS6_MORRIS3_230_115kV_3PH	3 phase fault on the MORRIS 6 (532863) 230 kV / (533305) 115 kV / (532890) 13.8 kV transformer, near MORRIS 6 230 kV. a. Apply fault at the MORRIS 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
58	FLT_58_MORRIS6_MORRIS7_230_345kV_3PH	3 phase fault on the MORRIS 6 (532863) 230 kV / (532770) 345 kV /(532809) 14.4 kV transformer, near MORRIS 6 230 kV. a. Apply fault at the MORRIS 6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
59	FLT_59_EMPEC7_MORRIS7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to MORRIS 7 (532770) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
60	FLT_60_EMPEC7_LANG7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to LANG 7 (532769) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
61	FLT_61_EMPEC7_G14001TAP_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to G14-001-TAP (562476) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
62	FLT_62_EMPEC7_SWISVAL7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to SWISVAL7 (532774) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
63	FLT_63_MORRIS7_JECN7_345kV_3PH	3 phase fault on the MORRIS 7 (532770) to JEC N 7 (532766) 345 kV line circuit 1, near MORRIS 7. a. Apply fault at the MORRIS 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
64	FLT_64_MORRIS7_MORRIS6_345_230kV_3PH	3 phase fault on the MORRIS (532770) 345 kV / (532863) 138 kV /(532809) 13.8 kV transformer, near MORRIS 7 345 kV. a. Apply fault at the MORRIS7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
65	FLT_65_SWISVAL7_WGRDNR7_345kV_3PH*	3 phase fault on the SWISVAL7 (532774) to W.GRDNR7 (542965) 345 kV line circuit 1, near SWISVAL7. *In 25SP: 3 phase fault on the SWISVAL7 (532774) to DOUGLAS7 (532776) 345 kV line circuit 1, near SWISVAL7. a. Apply fault at the SWISVAL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV_3PH	3 phase fault on the SWISVAL7 (532774) 345 kV / (532856) 230 kV /(532815) 14.4 kV transformer, near SWISVAL7 345. a. Apply fault at the SWISVAL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
67	FLT_67_LANG7_LANG3_345_115kV_3PH	3 phase fault on the LANG 7 (532769) 345 kV / (533304) 115 kV /(532808) 14.4 kV transformer, near LANG 7 345 kV. a. Apply fault at the LANG 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
68	FLT_68_G14001TAP_WICHITA7_345kV_3PH	3 phase fault on the G14-001-TAP (562476) to WICHITA7 (532796) 345 kV line circuit 1, near G14-001-TAP. a. Apply fault at the G14-001-TAP 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
69	FLT_69_SC10BEL4_FARBER4_138kV_3PH	3 phase fault on the SC10BEL4 (533063) to FARBER 4 (533042) 138 kV line circuit 1, near SC10BEL4. a. Apply fault at the SC10BEL4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
70	FLT_70_SC10BEL4_SUMNER4_138kV_3PH	3 phase fault on the SC10BEL4 (533063) to SUMNER 4 (532984) 138 kV line circuit 1, near SC10BEL4. a. Apply fault at the SC10BEL4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
71	FLT_71_FARBER4_ELPASO4_138kV_3PH	3 phase fault on the FARBER 4 (533042) to ELPASO 4 (533039) 138 kV line circuit 1, near FARBER 4. a. Apply fault at the FARBER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
72	FLT_72_SUMNER4_OXFORD4_138kV_3PH	3 phase fault on the SUMNER 4 (532984) to OXFORD 4 (532982) 138 kV line circuit 1, near SUMNER 4. a. Apply fault at the SUMNER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
73	FLT_73_SUMNER4_TIMBJCT4_138kV_3PH	3 phase fault on the SUMNER 4 (532984) to TIMBJCT4 (532992) 138 kV line circuit 1, near SUMNER 4. a. Apply fault at the SUMNER 4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
74	FLT_74_RANCHRD7_OPENSKY7_345kV_1PH	**Ranch Road 345 kV Single Phase Fault** a. Apply single-phase fault on the RANCHRD7 (515576) – OPENSKY7 (515621) 345 kV line, near RANCHRD7. b. Clear fault after 5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (a) and remove fault.
75	FLT_75_RANCHRD7_SOONER7_345kV_1PH	**Ranch Road 345 kV Single Phase Fault** a. Apply single-phase fault on the RANCHRD7 (515576) – SOONER 7 (514803) 345 kV line, near RANCHRD7. b. Clear fault after 5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (a) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
76	FLT_76_G1524G1525T_WICHITA7PO_345kV_3PH	**Prior outage on the G1524&G1525T (560033) – WICHITA7 (532796) 345 kV line circuit 1;** 3 phase fault on the G1524&G1525T (560033) to WICHITA7 (532796) 345 kV line circuit 2, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
77	FLT_77_G1524G1525T_THISTLE7PO_345kV_3PH	**Prior outage on the G1524&G1525T (560033) – THISTLE7 (539801) 345 kV line circuit 1;** 3 phase fault on the G1524&G1525T (560033) to THISTLE7 (539801) 345 kV line circuit 2, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
78	FLT_78_G1524G1525T_THISTLE7PO_345kV_3PH	**Prior outage on the G1524&G1525T (560033) – WICHITA7 (532796) 345 kV line circuit 1;** 3 phase fault on the G1524&G1525T (560033) to THISTLE7 (539801) 345 kV line circuit 2, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
79	FLT_79_G1524G1525T_WICHITA7PO_345kV_3PH	**Prior outage on the G1524&G1525T (560033) – THISTLE7 (539801) 345 kV line circuit 1;** 3 phase fault on the G1524&G1525T (560033) to WICHITA7 (532796) 345 kV line circuit 2, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
80	FLT_80_SOONER7_SPRNGCK7PO_345kV_3PH	**Prior outage on the SOONER 7 (514803) – RANCHRD (515576) 345 kV line;** 3 phase fault on the SOONER 7 (514803) to SPRNGCK7 (514881) 345 kV line, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
81	FLT_81_SOONER7_RANCHRD7PO_345kV_3PH	**Prior outage on the SOONER 7 (514803) – SPRNGCK7 (514881) 345 kV line;** 3 phase fault on the SOONER 7 (514803) to RANCHRD (515576) 345 kV line, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
82	FLT_82A_SOONER7_WOODRNG7PO_345kV_3PH	**Prior outage on the SOONER 7 (514803) – SPRNGCK7 (514881) 345 kV line;** 3 phase fault on the SOONER 7 (514803) to – G16061 Tap (560084) 345 kV line, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
83	FLT_82B_SOONER7_WOODRNG7PO_345kV_3PH	**Prior outage on the SOONER 7 (514803) – SPRNGCK7 (514881) 345 kV line;** 3 phase fault on – G16061 Tap (560084) to WOODRNG7 (514715) 345 kV line, near – G16061 Tap. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
84	FLT_83_SOONER7_SPRNGCK7PO_345kV_3PH	**Prior outage on the SOONER 7 (514803) 345/ (514802) 138/ (515760) 13.8 kV transformer;** 3 phase fault on the SOONER 7 (514803) to SPRNGCK7 (514881) 345 kV line, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
85	FLT_84_BRECKNR4_PLNSMEN4PO_138kV_3PH	**Prior outage on the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line circuit 1;** 3 phase fault on the BRECKNR4 (514815) to PLNSMEN4 (515641) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
86	FLT_85_BRECKNR4_BUNCHCK4PO_138kV_3PH	**Prior outage on the BRECKNR4 (514815) to PLNSMEN4 (515641) 138 kV line circuit 1;** 3 phase fault on the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
87	FLT_86_BRECKNR4_SO4TH4PO_138kV_3PH	**Prior outage on the BRECKNR4 (514815) to ENIDINT4 (515383) 138 kV line circuit 1;** 3 phase fault on the BRECKNR4 (514815) to SO4TH 4 (514731) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
88	FLT_87_BRECKNR4_BUNCHCK4PO_138kV_3PH	**Prior outage on the BRECKNR4 (514815) to SO4TH 4 (514731) 138 kV line circuit 1;** 3 phase fault on the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
89	FLT_88_EMPEC7_MORRIS7PO_345kV_3PH	**Prior outage on the EMPEC 7 (532768) – SWISVAL7 (532774) 345 kV line;** 3 phase fault on the EMPEC 7 (532768) to MORRIS 7 (532770) 345 kV line, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
90	FLT_89_EMPEC7_G14001TAPPO_345kV_3PH	**Prior outage on the EMPEC 7 (532768) – LANG 7 (532769) 345 kV line;** 3 phase fault on the EMPEC 7 (532768) to G14-001-TAP (562476) 345 kV line, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
91	FLT_90_EMPEC7_SWISVAL7PO_345kV_3PH	**Prior outage on the EMPEC 7 (532768) – MORRIS 7 (532770) 345 kV line;** 3 phase fault on the EMPEC 7 (532768) to SWISVAL7 (532774) 345 kV line, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
92	FLT_91_EMPEC7_MORRIS7PO_345kV_3PH	**Prior outage on the EMPEC 7 (532768) – G14-001-TAP (562476) 345 kV line;** 3 phase fault on the EMPEC 7 (532768) to MORRIS 7 (532770) 345 kV line, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
93	FLT_92_WICHITA7_G1524G1525TSB_345kV_1PH	**Stuck Breaker on Wichita – G1524&1525T 345 kV circuit 2 line** a. Apply single-phase fault at Wichita (532796) on the 345 kV bus. b. After 20 cycles, trip the Wichita 345/ (533040) 138/(532830) 13.8 kV transformer circuit 1 c. Trip the Wichita – G1524&G1525T (560033) 345 kV circuit 2 line, and remove the fault
94	FLT_93_WICHITA7_G1524G1525TSB_345kV_1PH	**Stuck Breaker on Wichita – G1524&1525T 345 kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345 kV bus. b. After 20 cycles, trip the Wichita - Viola (532798) 345 kV line circuit 1 c. Trip the Wichita – G1524&G1525T (560033) 345 kV circuit 1 line, and remove the fault
95	FLT_94_WICHITA7_G14001TAPSB_345kV_1PH	**Stuck Breaker on Wichita – G14-001 Tap 345 kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345 kV bus. b. After 20 cycles, trip the Wichita 345/ (533040) 138/(532829) 13.8 kV transformer circuit 1 c. Trip the Wichita – G14-001 Tap (562476) 345 kV line, and remove the fault
96	FLT_95_WICHITA7_RENO7SB_345kV_1PH	**Stuck Breaker on Wichita – Reno 345 kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345 kV bus. b. After 20 cycles, trip the Wichita – Benton (532791) 345 kV line circuit 1 c. Trip the Wichita – Reno (532771) 345 kV line, and remove the fault
97	FLT_96_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	**Stuck Breaker on Rosehill 345/138/13.8 kV circuit 1 transformer** a. Apply single-phase fault at Rosehill (532794) on the 345 kV bus. b. After 20 cycles, trip the Rosehill (532794) – Benton (532791) 345 kV line c. Trip the Rosehill 345/(533062) 138/(532831) 13.8 kV transformer circuit 1, and remove the fault

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
98	FLT_97_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	**Stuck Breaker on Rosehill 345/138/13.8 kV circuit 3 transformer** a. Apply single-phase fault at Rosehill (532794) on the 345 kV bus. b. After 20 cycles, trip the Rosehill (532794) – Wolf Creek (532797) 345 kV line c. Trip the Rosehill 345/(533062) 138/(532827) 13.8 kV transformer circuit 3, and remove the fault
99	FLT_98_BRECKNR4_BUNCHCK4SB_138kV_1PH	**Stuck Breaker on BRECKNR4 - BUNCHCK4 138 kV line** a. Apply single-phase fault at Breckenridge 138 kV (514815) b. After 20 cycles, trip the BRECKNR4 (514815) to ENIDINT4 (515383) 138 kV line c. Trip the BRECKNR4 (514815) - BUNCHCK4 (514701) 138 kV line, and remove the fault
100	FLT_99_BRECKNR4_SO4TH4SB_138kV_1PH	**Stuck Breaker on BRECKNR4 - SO4TH4 138 kV line** a. Apply single-phase fault at Breckenridge 138 kV (514815) b. After 20 cycles, trip the BRECKNR4 (514815) to PLNSMEN4 (515641) 138 kV line c. Trip the BRECKNR4 (514815) - SO4TH 4 (514731) 138 kV line, and remove the fault
101	FLT_100_SOONER4_SOONER7SB_138_345kV_1PH	**Stuck Breaker on Sooner 138 kV/345 kV/13.8 kV transformer** a. Apply single-phase fault at the Sooner 138 kV (514802) b. After 16 cycles, trip the Sooner – MORISNT4 (515447) 138 kV line c. Trip the Sooner 138 kV (514802)/345 kV (514803)/13.8 kV (515760) transformer, and remove the fault
102	FLT_101_SOONER4_MILLERT4SB_138kV_1PH	**Stuck Breaker on Sooner - MILLERT4 138 kV line** a. Apply single-phase fault at Sooner (514802) 138 kV b. After 16 cycles, trip the Sooner (514802) - SNRPMPT4 (514798) 138 kV line c. Trip the Sooner - MILLERT4 (514704) 138 kV line, and remove the fault
103	FLT_102_UNIONRG6_UNIONRG3_230_115kV_3PH	**Stuck Breaker on UNIONRG 6 - SUMMIT 6 230 kV line** a. Apply single-phase fault at Union Ridge 230 kV (532874) b. After 20 cycles, trip the UNIONRG6 (532874) to MORRIS 6 (532863) 230 kV line c. Trip the UNIONRG6 (532874) - SUMMIT 6 (532873) 230 kV line, and remove the fault
104	FLT_103_EMPEC7_SWISVAL7SB_345kV_1PH	**Stuck Breaker on EMPEC 7 - SWISVAL7 345 kV line** a. Apply single-phase fault at Emporia (532768) 345 kV b. After 20 cycles, trip the EMPEC 7 (532768) to MORRIS 7 (532770) 345 kV line c. Trip the EMPEC 7 (532768) to SWISVAL7 (532774) 345 kV line, and remove the fault
105	FLT_104_EMPEC7_G14001TAPSB_345kV_1PH	**Stuck Breaker on EMPEC 7 - G14-001-TAP 345 kV line** a. Apply single-phase fault at Emporia (532768) 345 kV b. After 20 cycles, trip the EMPEC 7 (532768) to LANG 7 (532769) 345 kV line c. Trip the EMPEC 7 (532768) - G14-001-TAP (562476) 345 kV line, and remove the fault
106	FLT_105_SOONER7_RANCHRD7SB_345kV_1PH	**Stuck Breaker on Sooner – Ranch Road 345 kV line** a. Apply single-phase fault at Sooner (514803) 345 kV bus on the Sooner – Ranch Road 345 kV line b. After 20 cycles, trip the Sooner (514803) – Woodring 345 kV line c. Trip the Sooner– Ranch Road (515576) line, and remove the fault
107	FLT_106_SOONER7_G16061TAP_345kV_1PH	**Stuck Breaker on Sooner – G16061 Tap kV line** a. Apply single-phase fault at Sooner (514803) 345 kV bus on the Sooner – G16061 Tap (560084) 345 kV line b. After 20 cycles, trip the Sooner (514803) – Spring Creek (514881) 345 kV line c. Trip the Sooner– – G16061 Tap (560084) line, and remove the fault
108	FLT_107_RANCHRD7_OPENSKY7SB_345kV_1PH	**Stuck Breaker on Ranch Road 7 – Open Sky 7 345 kV line** a. Apply single-phase fault at Ranch Road 7 (515576) 345 kV b. After 20 cycles, trip the Ranch Road 7 (515576) – Omcdlec 7 (529200) 345 kV line c. Trip the Ranch Road 7 (515576) – Open Sky 7 (515621) 345 kV line, and remove the fault
109	FLT_108_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	**Stuck Breaker on Rosehill 345/138/13.8 kV circuit 1 transformer** a. Apply single-phase fault at Rosehill (532794) on the 345 kV bus. b. After 20 cycles, trip the Rosehill (532794) – Benton (532791) 345 kV line c. Trip the Rosehill (532794) 345/(533062) 138/(532826) 13.8 kV transformer circuit 1, and remove the fault
110	FLT_109_BRECKNR4_SO4TH4SB_138kV_1PH	**Stuck Breaker on BRECKNR4 – SO4TH 4 138 kV line** a. Apply single-phase fault at BRECKNR4 138 kV (514815) b. After 20 cycles, trip the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line c. Trip the BRECKNR4 (514815) – SO4TH 4 (514731) 138 kV line, and remove the fault
111	FLT_110_WOODRNG7_G16061TAPSB_345kV_1PH	**Stuck Breaker on Woodring 7 – G16061 Tap 345 kV line** a. Apply single-phase fault at Woodring 7 (514715) at the 345 kV bus b. After 20 cycles, trip the Woodring 7 (514715) to Hunters 7 (515476) 345 kV line c. Trip the Woodring 7 (514715) – G16061 Tap (560084) 345 kV line, and remove the fault
112	FLT_111_CLEVLND7_CLEVLND4SB_345_138kV_1PH	**Stuck Breaker on Cleveland 345/138/13.8 kV circuit 1 transformer** a. Apply single-phase fault at Cleveland 7 (512694) on the 345 kV bus. b. After 20 cycles, trip the Cleveland 7 (512694) – T.NO.--7 (509852) 345 kV line c. Trip the Cleveland 7 (512694) 345/(512729) 138/(512817) 13.8 kV transformer circuit 1, and remove the fault

Table 3-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
113	FLT_112_UNIONRG6_UNIONRG3SB_230_115kV_1PH	**Stuck Breaker on Union Ridge 6 230 kV/115 kV/13.2 kV transformer** a. Apply single-phase fault at the UNIONRG6 230 kV (532874) b. After 20 cycles, trip the UNIONRG6– SUMMIT6 (532873) 230 kV line c. Trip the UNIONRG6 (532874) 230kV /(533359) 115 kV/(532817) 13.2 kV transformer, and remove the fault
114	FLT_113_EMPEC7_MORRIS7SB_345kV_1PH	**Stuck Breaker on EMPEC 7 – MORRIS 7 345 kV line** a. Apply single-phase fault at Emporia (532768) 345 kV b. After 20 cycles, trip the EMPEC 7 (532768) to G14-001-TAP (562476) 345 kV line c. Trip the EMPEC 7 (532768) to Morris 7 (532770) 345 kV line, and remove the fault
115	FLT_114_FARBER4_SC10BEL4SB_138kV_1PH	**Stuck Breaker on FARBER 4 – SC10BEL 4 138 kV line** a. Apply single-phase fault at FARBER 4 (533042) 138 kV b. After 20 cycles, trip the FARBER 4 (533042) to ELPASO 4 (533039) 138 kV line c. Trip the FARBER 4 (533042) to SC10BEL 4 (533063) 138 kV line, and remove the fault
116	FLT_115_G1524G1525T_WICHITA7SB_345kV_1PH	**Stuck Breaker on G1524&G1525T – Wichita 7 345 kV line** a. Apply single-phase fault at G1524&G1525T (560033) 345 kV b. After 20 cycles, trip the G1524&G1525T (560033) to Thistle 7 (539801) 345 kV line circuit 1 c. Trip the G1524&G1525T (560033) to Wichita 7 (532796) 345 kV line circuit 1, and remove the fault

Results

The stability analysis was performed and the results are summarized in **Table 3-2**, below. The stability plots will be available upon customer request.

Table 3-2: Results

Contingency Number and Name		DISIS-2015-002-4 G8 Cluster		
		2016WP	2017SP	2025SP
0	FLT_000_NOFAULT	STABLE	STABLE	STABLE
1	FLT_01_RANCHRD7_OPENSKY7_345kV_3PH	STABLE	STABLE	STABLE
2	FLT_02_RANCHRD7_SOONER7_345kV_3PH	STABLE	STABLE	STABLE
3	FLT_03_OPENSKY7_G15052_345kV_3PH	STABLE	STABLE	STABLE
4	FLT_04_SOONER7_G16061TAP_345kV_3PH	STABLE	STABLE	STABLE
5	FLT_05_G16061TAP_WOODRNG7_345kV_3PH	STABLE	STABLE	STABLE
6	FLT_06_SOONER7_G15066_345kV_3PH	STABLE	STABLE	STABLE
7	FLT_07_SOONER7_SOONER4_345_138kV_3PH	STABLE	STABLE	STABLE
8	FLT_08_SOONER7_SPRNGCK7_345kV_3PH	STABLE	STABLE	STABLE
9	FLT_09_G1524G1525T_THISTLE7_345kV_3PH	STABLE	STABLE	STABLE
10	FLT_10_G1524G1525T_WICHITA7_345kV_3PH	STABLE	STABLE	STABLE
11	FLT_11_THISTLE7_G16005TAP_345kV_3PH	STABLE	STABLE	STABLE
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV_3PH	STABLE	STABLE	STABLE
13	FLT_13_THISTLE7_WWRDEHV7_345kV_3PH	STABLE	STABLE	STABLE
14	FLT_14_THISTLE7_THISTLE4_345_138kV_3PH	STABLE	STABLE	STABLE
15	FLT_15_WICHITA7_VIOLA7_345kV_3PH	STABLE	STABLE	STABLE
16	FLT_16_WICHITA7_RENO7_345kV_3PH	STABLE	STABLE	STABLE
17	FLT_17_WICHITA7_BENTON7_345kV_3PH	STABLE	STABLE	STABLE
18	FLT_18_WICHITA7_G14001TAP_345kV_3PH	STABLE	STABLE	STABLE
19	FLT_19_WICHITA7_EVANSN4_345_138kV_3PH	STABLE	STABLE	STABLE
20	FLT_20_WOODRNG7_G15063_345kV_3PH	STABLE	STABLE	STABLE
21	FLT_21_WOODRNG7_HUNTERS7_345kV_3PH	STABLE	STABLE	STABLE
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV_3PH	STABLE	STABLE	STABLE
23	FLT_23_SOONER4_SNRPMPT4_138kV_3PH	STABLE	STABLE	STABLE
24	FLT_24_SOONER4_PERRY4_138kV_3PH	STABLE	STABLE	STABLE
25	FLT_25_SOONER4_MILLERT4_138kV_3PH	STABLE	STABLE	STABLE
26	FLT_26_SOONER4_MORISNT4_138kV_3PH	STABLE	STABLE	STABLE
27	FLT_27_SPRNGCK7_NORTWST7_345kV_3PH	STABLE	STABLE	STABLE
28	FLT_28_G15066_CLEVLND7_345kV_3PH	STABLE	STABLE	STABLE
29	FLT_29_G15052_ROSEHIL7_345kV_3PH	STABLE	STABLE	STABLE
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV_3PH	STABLE	STABLE	STABLE
31	FLT_31_ROSEHIL7_BENTON7_345kV_3PH	STABLE	STABLE	STABLE
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV_3PH	STABLE	STABLE	STABLE
33	FLT_33_ROSEHIL7_LATHAMS7_345kV_3PH	STABLE	STABLE	STABLE
34	FLT_34_BRECKNR4_SO4TH4_138kV_3PH	STABLE	STABLE	STABLE
35	FLT_35_BRECKNR4_BUNCHCK4_138kV_3PH	STABLE	STABLE	STABLE
36	FLT_36_BRECKNR4_ENIDINT4_138kV_3PH	STABLE	STABLE	STABLE
37	FLT_37_BRECKNR4_PLNSMEN4_138kV_3PH	STABLE	STABLE	STABLE
38	FLT_38_SO4TH4_SO4TH2_138_69kV_3PH	STABLE	STABLE	STABLE
39	FLT_39_SO4TH4_IMO4_138kV_3PH	STABLE	STABLE	STABLE
40	FLT_40_SO4TH4_WAUKOTP4_138kV_3PH	STABLE	STABLE	STABLE
41	FLT_41_SO4TH4_FRMNTAP4_138kV_3PH	STABLE	STABLE	STABLE
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV_3PH	STABLE	STABLE	STABLE
43	FLT_43_ENIDINT4_NRTHSTR4_138kV_3PH	STABLE	STABLE	STABLE
44	FLT_44_PLNSMEN4_FAIRMON4_138kV_3PH	STABLE	STABLE	STABLE
45	FLT_45_G15063_MATHWSN7_345kV_3PH	STABLE	STABLE	STABLE
46	FLT_46_MATHWSN7_CIMARON7_345kV_3PH	STABLE	STABLE	STABLE
47	FLT_47_CLEVLND7_TNO7_345kV_3PH	STABLE	STABLE	STABLE
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV_3PH	STABLE	STABLE	STABLE
49	FLT_49_UNIONRG6_SUMMIT6_230kV_3PH	STABLE	STABLE	STABLE
50	FLT_50_UNIONRG6_MORRIS6_230kV_3PH	STABLE	STABLE	STABLE
51	FLT_51_SUMMIT6_MCPHER6_230kV_3PH	STABLE	STABLE	STABLE
52	FLT_52_SUMMIT6_SMOKYHL6_230kV_3PH	STABLE	STABLE	STABLE
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV_3PH	STABLE	STABLE	STABLE
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV_3PH	STABLE	STABLE	STABLE
55	FLT_55_MORRIS6_MCDOWEL6_230kV_3PH	STABLE	STABLE	STABLE
56	FLT_56_MORRIS6_SWISVAL6_230kV_3PH	STABLE	STABLE	STABLE
57	FLT_57_MORRIS6_MORRIS3_230_115kV_3PH	STABLE	STABLE	STABLE
58	FLT_58_MORRIS6_MORRIS7_230_345kV_3PH	STABLE	STABLE	STABLE
59	FLT_59_EMPEC7_MORRIS7_345kV_3PH	STABLE	STABLE	STABLE
60	FLT_60_EMPEC7_LANG7_345kV_3PH	STABLE	STABLE	STABLE
61	FLT_61_EMPEC7_G14001TAP_345kV_3PH	STABLE	STABLE	STABLE
62	FLT_62_EMPEC7_SWISVAL7_345kV_3PH	STABLE	STABLE	STABLE
63	FLT_63_MORRIS7_JECN7_345kV_3PH	STABLE	STABLE	STABLE
64	FLT_64_MORRIS7_MORRIS6_345_230kV_3PH	STABLE	STABLE	STABLE
65	FLT_65_SWISVAL7_WGRDNR7_345kV_3PH*	STABLE	STABLE	STABLE
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV_3PH	STABLE	STABLE	STABLE
67	FLT_67_LANG7_LANG3_345_115kV_3PH	STABLE	STABLE	STABLE
68	FLT_68_G14001TAP_WICHITA7_345kV_3PH	STABLE	STABLE	STABLE
69	FLT_69_SC10BEL4_FARBER4_138kV_3PH	STABLE	STABLE	STABLE
70	FLT_70_SC10BEL4_SUMNER4_138kV_3PH	STABLE	STABLE	STABLE
71	FLT_71_FARBER4_ELPASO4_138kV_3PH	STABLE	STABLE	STABLE
72	FLT_72_SUMNER4_OXFORD4_138kV_3PH	STABLE	STABLE	STABLE
73	FLT_73_SUMNER4_TIMBJCT4_138kV_3PH	STABLE	STABLE	STABLE
74	FLT_74_RANCHRD7_OPENSKY7_345kV_1PH	STABLE	STABLE	STABLE
75	FLT_75_RANCHRD7_SOONER7_345kV_1PH	STABLE	STABLE	STABLE
76	FLT_76_G1524G1525T_WICHITA7PO_345kV_3PH	STABLE	STABLE	STABLE
77	FLT_77_G1524G1525T_THISTLE7PO_345kV_3PH	STABLE	STABLE	STABLE
78	FLT_78_G1524G1525T_THISTLE7PO_345kV_3PH	STABLE	STABLE	STABLE
79	FLT_79_G1524G1525T_WICHITA7PO_345kV_3PH	STABLE	STABLE	STABLE
80	FLT_80_SOONER7_SPRNGCK7PO_345kV_3PH	STABLE	STABLE	STABLE
81	FLT_81_SOONER7_RANCHRD7PO_345kV_3PH	STABLE	STABLE	STABLE

Contingency Number and Name		DISIS-2015-002-4 G8 Cluster		
		2016WP	2017SP	2025SP
82	FLT_82A_SOONER7_WOODRNG7PO_345kV_3PH	STABLE	STABLE	STABLE
83	FLT_82B_SOONER7_WOODRNG7PO_345kV_3PH	STABLE	STABLE	STABLE
84	FLT_83_SOONER7_SPRNGCK7PO_345kV_3PH	STABLE	STABLE	STABLE
85	FLT_84_BRECKNR4_PLNSMEN4PO_138kV_3PH	STABLE	STABLE	STABLE
86	FLT_85_BRECKNR4_BUNCHCK4PO_138kV_3PH	STABLE	STABLE	STABLE
87	FLT_86_BRECKNR4_SO4TH4PO_138kV_3PH	STABLE	STABLE	STABLE
88	FLT_87_BRECKNR4_BUNCHCK4PO_138kV_3PH	STABLE	STABLE	STABLE
89	FLT_88_EMPEC7_MORRIS7PO_345kV_3PH	STABLE	STABLE	STABLE
90	FLT_89_EMPEC7_G14001TAPPO_345kV_3PH	STABLE	STABLE	STABLE
91	FLT_90_EMPEC7_SWISVAL7PO_345kV_3PH	STABLE	STABLE	STABLE
92	FLT_91_EMPEC7_MORRIS7PO_345kV_3PH	STABLE	STABLE	STABLE
93	FLT_92_WICHITA7_G1524G1525TSB_345kV_1PH	STABLE	STABLE	STABLE
94	FLT_93_WICHITA7_G1524G1525TSB_345kV_1PH	STABLE	STABLE	STABLE
95	FLT_94_WICHITA7_G14001TAPSB_345kV_1PH	STABLE	STABLE	STABLE
96	FLT_95_WICHITA7_RENO7SB_345kV_1PH	STABLE	STABLE	STABLE
97	FLT_96_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	STABLE	STABLE	STABLE
98	FLT_97_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	STABLE	STABLE	STABLE
99	FLT_98_BRECKNR4_BUNCHCK4SB_138kV_1PH	STABLE	STABLE	STABLE
100	FLT_99_BRECKNR4_SO4TH4SB_138kV_1PH	STABLE	STABLE	STABLE
101	FLT_100_SOONER4_SOONER7SB_138_345kV_1PH	STABLE	STABLE	STABLE
102	FLT_101_SOONER4_MILLERT4SB_138kV_1PH	STABLE	STABLE	STABLE
103	FLT_102_UNIONRG6_UNIONRG3_230_115kV_3PH	STABLE	STABLE	STABLE
104	FLT_103_EMPEC7_SWISVAL7SB_345kV_1PH	STABLE	STABLE	STABLE
105	FLT_104_EMPEC7_G14001TAPSB_345kV_1PH	STABLE	STABLE	STABLE
106	FLT_105_SOONER7_RANCHRD7SB_345kV_1PH	STABLE	STABLE	STABLE
107	FLT_106_SOONER7_G16061TAP_345kV_1PH	STABLE	STABLE	STABLE
108	FLT_107_RANCHRD7_OPENSKY7SB_345kV_1PH	STABLE	STABLE	STABLE
109	FLT_108_ROSEHIL7_ROSEHIL4SB_345_138kV_1PH	STABLE	STABLE	STABLE
110	FLT_109_BRECKNR4_SO4TH4SB_138kV_1PH	STABLE	STABLE	STABLE
111	FLT_110_WOODRNG7_G16061TAPSB_345kV_1PH	STABLE	STABLE	STABLE
112	FLT_111_CLEVLND7_CLEVLND4SB_345_138kV_1PH	STABLE	STABLE	STABLE
113	FLT_112_UNIONRG6_UNIONRG3SB_230_115kV_1PH	STABLE	STABLE	STABLE
114	FLT_113_EMPEC7_MORRIS7SB_345kV_1PH	STABLE	STABLE	STABLE
115	FLT_114_FARBER4_SC10BEL4SB_138kV_1PH	STABLE	STABLE	STABLE
116	FLT_115_G1524G1525T_WICHITA7SB_345kV_1PH	STABLE	STABLE	STABLE

FERC LVRT Compliance

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu. The faults listed below in **Table 3-3** were tested to meet Order 661A LVRT provisions. The results are listed in **Table 3-2.**

Table 3-3 LVRT Contingencies

Contingency Number and Name	Description
FLT_01_RANCHRD7_OPENSKY7_345kV_3PH	3 phase fault on the RANCHRD7 (515576) to OPENSKY7 (515621) 345 kV line circuit 1, near RANCHRD7. a. Apply fault at the RANCHRD7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_02_RANCHRD7_SOONER7_345kV_3PH	3 phase fault on the RANCHRD7 (515576) to SOONER 7 (514803) 345 kV line circuit 1, near RANCHRD7. a. Apply fault at the RANCHRD7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_03_OPENSKY7_G15052_345kV_3PH	3 phase fault on the OPENSKY7 (515621) to G15052 (560053) 345 kV line circuit 1, near OPENSKY7. a. Apply fault at the OPENSKY7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_04_SOONER7_G16061TAP_345kV_3PH	3 phase fault on the SOONER 7 (514803) to G16061 Tap (560084) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_06_SOONER7_G15066_345kV_3PH	3 phase fault on the SOONER 7 (514803) to G15066 (560056) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_07_SOONER7_SOONER4_345_138kV_3PH	3 phase fault on the SOONER 7 (514803) 345 kV /(514802) 138 kV /(515760) 13.8 kV transformer, near SOONER 7 345 kV. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
FLT_08_SOONER7_SPRNGCK7_345kV_3PH	3 phase fault on the SOONER 7 (514803) to SPRNGCK7 (514881) 345 kV line circuit 1, near SOONER 7. a. Apply fault at the SOONER 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_09_G1524G1525T_THISTLE7_345kV_3PH	3 phase fault on the G1524&G1525T (560033) to THISTLE7 (539801) 345 kV line circuit 1, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_10_G1524G1525T_WICHITA7_345kV_3PH	3 phase fault on the G1524&G1525T (560033) to WICHITA7 (532796) 345 kV line circuit 1, near G1524&G1525T. a. Apply fault at the G1524&G1525T 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

FLT_29_G15052_ROSEHIL7_345kV_3PH	3 phase fault on the G15052 (560053) to ROSEHIL7 (532794) 345 kV line circuit 1, near G15052. a. Apply fault at the G15052 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_34_BRECKNR4_SO4TH4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to SO4TH 4 (514731) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_35_BRECKNR4_BUNCHCK4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to BUNCHCK4 (514701) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_36_BRECKNR4_ENIDINT4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to ENIDINT4 (515383) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_37_BRECKNR4_PLNSMEN4_138kV_3PH	3 phase fault on the BRECKNR4 (514815) to PLNSMEN4 (515641) 138 kV line circuit 1, near BRECKNR4. a. Apply fault at the BRECKNR4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_20_WOODRNG7_G15063_345kV_3PH	3 phase fault on the WOODRNG7 (514715) to G15063 (560055) 345 kV line circuit 1, near WOODRNG7. a. Apply fault at the WOODRNG7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_45_G15063_MATHWSN7_345kV_3PH	3 phase fault on the G15063 (560055) to MATHWSN7 (515497) 345 kV line circuit 1, near G15063. a. Apply fault at the G15063 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_28_G15066_CLEVLND7_345kV_3PH	3 phase fault on the G15066 (560056) to CLEVLND7 (512694) 345 kV line circuit 1, near G15066. a. Apply fault at the G15066 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_49_UNIONRG6_SUMMIT6_230kV_3PH	3 phase fault on the UNIONRG6 (532874) to SUMMIT 6 (532873) 230 kV line circuit 1, near UNIONRG6. a. Apply fault at the UNIONRG6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_50_UNIONRG6_MORRIS6_230kV_3PH	3 phase fault on the UNIONRG6 (532874) to MORRIS 6 (532863) 230 kV line circuit 1, near UNIONRG6. a. Apply fault at the UNIONRG6 230 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_59_EMPEC7_MORRIS7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to MORRIS 7 (532770) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_60_EMPEC7_LANG7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to LANG 7 (532769) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus.

	b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_61_EMPEC7_G14001TAP_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to G14-001-TAP (562476) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_62_EMPEC7_SWISVAL7_345kV_3PH	3 phase fault on the EMPEC 7 (532768) to SWISVAL7 (532774) 345 kV line circuit 1, near EMPEC 7. a. Apply fault at the EMPEC 7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_69_SC10BEL4_FARBER4_138kV_3PH	3 phase fault on the SC10BEL4 (533063) to FARBER 4 (533042) 138 kV line circuit 1, near SC10BEL4. a. Apply fault at the SC10BEL4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT_70_SC10BEL4_SUMNER4_138kV_3PH	3 phase fault on the SC10BEL4 (533063) to SUMNER 4 (532984) 138 kV line circuit 1, near SC10BEL4. a. Apply fault at the SC10BEL4 138 kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

4. Power Factor Analysis

The power factor analysis was performed for each project included in this study and is designed to demonstrate the reactive power requirements at the point of interconnection (POI) using the current study upgrade cases. For all projects that require reactive power, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the POI.

Model Preparation

For each project included in this study, as well as previous queued projects modeled at the same POI, the projects were turned off for the power factor analysis. The projects were replaced by an equivalent generator located at the POI producing the total MW of the project at that POI and 0.0 Mvar capability.

A Mvar generator without limits was modeled at the interconnection project POI to hold a voltage schedule at the POI consistent with the greater of the voltage schedule in the base case or unity (1.0 pu) voltage.

Disturbances

Each N-1 contingency evaluated in the Stability Analysis found in **Table 3-1** was also included in the determination of the power factor requirements.

Results

The power factor ranges are summarized in

Table 4-1*: Summary of Power Factor Analysis at the POI*

and the resultant ranges are shown in Tables D-1 to D-10, starting here. The analysis showed that reactive power is required for the study project, the final requirement in the Generation Interconnection Agreement (GIA) for each project will be the pro-forma 95% lagging to 95% leading at the POI.

For analyzing power factor results a positive Q (Mvar) output indicts that the equivalent generator is supplying reactive power to the system, implying a lagging power factor. A negative Q (Mvar) output indicts that the equivalent generator is absorbing reactive power from the system, implying a leading power factor.

Table 4-1*: Summary of Power Factor Analysis at the POI*

Request	Capacity (MW)	Point of Interconnection (POI)	Fuel	Generator	Lagging (providing Mvars)	Leading (absorbing Mvars)
GEN-2015-034	200	Ranch Road 345kV (515576)	Wind	Vestes V112- 2MW	0.95	0.95
GEN-2015-047	300	Sooner 345kV Tap (514803)	Wind	Vestes V110-2MW	0.95	0.95
GEN-2015-052	300	Tap on Opensky (515621) to RoseHill (532794) 345 kV (560053)	Wind	Vestes V110-2MW	0.95	0.95
GEN-2015-062	4.5	Breckenridge 138kV (514815)	Wind	GE 1.79MW	0.95	0.95
GEN-2015-063	300	Tap on Woodring (514715) to Matthewson (515497) 345 kV (560055)	Wind	Vestes V110-2MW	0.95	0.95
GEN-2015-066	248.4	Tap on Cleveland (512694) to Sooner (514803) 345 kV (560056)	Wind	GE 2.3MW	0.95	0.95
GEN-2015-069	300	Union Ridge 230kV (532874)	Wind	Vestes V110-2MW	0.95	0.95
GEN-2015-073	200.1	Emporia/Lang 345kV (532768)	Wind	Siemens 2.3MW	0.95	0.95
GEN-2015-083	125	Belle Plain 138kV (533063)	Wind	GE 2.3MW	0.95	0.95
GEN-2015-090	220	Wichita (532796)-Thistle (539801) 345kV Tap (GEN-2015-024 (560033) 345kV)	Wind	GE 2MW	0.95	0.95

NOTE: As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

5. Reduced Wind Generation Analysis

A low wind analysis has been performed for the GEN-2015-034, GEN-2015-047, GEN-2015-052, GEN-2015-062, GEN-2015-063, GEN-2015-066, GEN-2015-069, GEN-2015-073, GEN-2015-083 & GEN-2015-090 Interconnection Requests. SPP performed this low wind analysis for excessive capacitive charging current for the addition of the Interconnection Request facilities. The high side of the each Interconnection Customer's transformer will interconnect to The Point of Interconnection (POI).

The project generators and capacitors (if any) were turned off in the base case. The resulting reactive power injection into the transmission network comes from the capacitance of the project's transmission lines and collector cables is shown in Figure E-1 through E-20.

Final shunt reactor requirement for each project with the model information provided to SPP is shown in **Table 5-1**. It is the interconnection customer's responsibility to design and install the reactive compensation equipment necessary to control the reactive power injection at the POI. If an equivalent means of compensation is installed, the reactive power required may vary with system conditions (e.g. a higher compensation amount is required for voltages above unity at the POI and a lower compensation amount is required for voltages below unity at the POI).

Table 5-1*: Summary of Reduced Wind Generation Analysis*

Request	Point of Interconnection (POI)	Reactor Size (Mvar)
GEN-2015-034	Ranch Road 345kV (515576)	11.7
GEN-2015-047	Sooner 345kV Tap (514803)	37.4
GEN-2015-052	Tap on Opensky (515621) to RoseHill (532794) 345 kV (560053)	23.5
GEN-2015-062	Breckenridge 138kV (514815)	4.6
GEN-2015-063	Tap on Woodring (514715) to Matthewson (515497) 345 kV (560055)	15.2
GEN-2015-066	Tap on Cleveland (512694) to Sooner (514803) 345 kV (560056)	13
GEN-2015-069	Union Ridge 230kV (532874)	27.9
GEN-2015-073	Emporia/Lang 345kV (532768)	14.5
GEN-2015-083	Belle Plain 138kV (533063)	8.7
GEN-2015-090	Wichita (532796)-Thistle (539801) 345kV Tap (GEN-2015-024 (560033) 345kV)	10

6. Short Circuit Analysis

The short circuit analysis was performed on the 2017 summer peak and 2025 summer peak power flow cases using the PSS/E ASCC program. Since the power flow model does not contain negative and zero sequence data, only three-phase symmetrical fault current levels were calculated at the point of interconnection up to and including five levels away.

Short Circuit Analysis was conducting using flat conditions with the following PSS/E ASCCC program settings:

- BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
- GENERATOR P=0, Q=0
- TRANSFORMER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
- LINE CHARGING=0.0 IN +/-/0 SEQUENCE
- LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
- LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
- DC LINES AND FACTS DEVICES BLOCKED
- TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

Results

The results of the short circuit analysis are shown in **Appendix F**.

7. Conclusion

DISIS-2015-002-4 Group 8 Interconnection Customer(s) have requested an Impact Study to determine the impacts of interconnecting generation to the SPP Transmission System.

A stability cluster impact analysis was performed for the generation projects from the DISIS-2015-002-4 Group 8 study. The analysis was performed on three (3) seasonal models including 2016 winter peak (16WP), the 2017 summer peak (17SP), and the 2025 summer peak (25SP) cases. These cases are modified versions of the 2015 model series of Model Development Working Group (MDWG) dynamic study models. A total of one hundred sixteen (116) contingencies were evaluated for the three (3) seasonal cases.

The stability analysis has determine with all previously assigned network upgrades, all generators in the monitored areas remained stable and within the pre-contingency, voltage recovery, and post fault voltage recovery criterion of 0.7pu to 1.2pu for the entire modeled disturbances. Under certain system conditions the interconnection requests may be required to curtail generation output to maintain system reliability.

In addition to the cluster impact stability analysis, a stand-alone stability analysis was conducted for each request.

Power factor analysis for each generation project was performed on the current study 2016 winter peak, 2017 summer peak, and 2025 summer peak cases with identified system upgrades. As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

A reduced generation analysis was conducted for wind farms to determine reactor size necessary to compensate the capacitive effects on the transmission system during low or reduced wind conditions caused by the interconnecting project's generator lead transmission line and collector systems. Each request may be required to install the following reactors on their facilities: GEN-2015-034 – 11.7 Mvar, GEN-2015-047 – 37.4 Mvar, GEN-2015-052 – 23.5 Mvar, GEN-2015-062 – 4.6 Mvar, GEN-2015-063 – 15.2 Mvar, GEN-2015-066 – 13 Mvar, GEN-2015-069 – 27.9 Mvar, GEN-2015-073 – 14.5 Mvar, GEN-2015-083 – 8.7 Mvar, and GEN-2015-090 – 10 Mvar .

Short Circuit analysis was conducted using the current study 2017 summer peak and 2025 summer peak cases with identified system upgrades.

Nothing in this study should be construed as a guarantee of delivery or transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the Customer.

Appendix A – 2016 Winter Peak Stability Plots

(Available on request)

Appendix B – 2017 Summer Peak Stability Plots

(Available on request)

Appendix C – 2025 Summer Peak Stability Plots

(Available on request)

Appendix D – Power Factor Analysis Results

Table D-1: GEN-2015-034 Power Factor Analysis Results

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
GEN-2015-034 POI Ranch Road 345 kV (515576) Power at POI (MW): 200.0		2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.010 pu			2025 Summer Peak POI Voltage = 1.010 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	12.26	0.998	LAG	7.12	0.999	LAG	7.11	0.999	LAG
1	FLT_01_RANCHRD7_OPENSKY7_345kV	-2.41	1	LEAD	-3.36	1	LEAD	-3.69	1	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	49.96	0.97	LAG	40.61	0.98	LAG	42.45	0.978	LAG
3	FLT_03_OPENSKY7_G15052_345kV	17.39	0.996	LAG	18.24	0.996	LAG	17.8	0.996	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	19.24	0.995	LAG	14.95	0.997	LAG	16.11	0.997	LAG
5	FLT_05_G16061TAP_WOODRNG7_345kV	16.52	0.997	LAG	11.95	0.998	LAG	13.13	0.998	LAG
6	FLT_06_SOONER7_G15066_345kV	7.71	0.999	LAG	9.45	0.999	LAG	7.65	0.999	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	12.07	0.998	LAG	5.56	1	LAG	5.68	1	LAG
8	FLT_08_SOONER7_SPRNGCK7_345kV	23.63	0.993	LAG	20.47	0.995	LAG	20.03	0.995	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	14.79	0.997	LAG	8.5	0.999	LAG	8.47	0.999	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	13.44	0.998	LAG	7.65	0.999	LAG	7.54	0.999	LAG
11	FLT_11_THISTLE7_G16005TAP_345kV	13.02	0.998	LAG	7.5	0.999	LAG	7.51	0.999	LAG
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	12.55	0.998	LAG	7.26	0.999	LAG	7.25	0.999	LAG
13	FLT_13_THISTLE7_WWRDEHV7_345kV	12.22	0.998	LAG	7.1	0.999	LAG	7.17	0.999	LAG
14	FLT_14_THISTLE7_THISTLE4_345_138kV	12.59	0.998	LAG	7.33	0.999	LAG	7.23	0.999	LAG
15	FLT_15_WICHITA7_VIOLA7_345kV	26.55	0.991	LAG	21.94	0.994	LAG	11.05	0.998	LAG
16	FLT_16_WICHITA7_RENO7_345kV	18.33	0.996	LAG	9.81	0.999	LAG	10.06	0.999	LAG
17	FLT_17_WICHITA7_BENTON7_345kV	21.02	0.995	LAG	14.4	0.997	LAG	18.28	0.996	LAG
18	FLT_18_WICHITA7_G14001TAP_345kV	14.28	0.997	LAG	8.43	0.999	LAG	8.23	0.999	LAG
19	FLT_19_WICHITA7_EVANSN4_345_138kV	14.23	0.997	LAG	6.31	1	LAG	5.96	1	LAG
20	FLT_20_WOODRNG7_G15063_345kV	23.24	0.993	LAG	16.04	0.997	LAG	14.81	0.997	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	17.7	0.996	LAG	8.38	0.999	LAG	7.97	0.999	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	13.66	0.998	LAG	7.99	0.999	LAG	7.43	0.999	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	13.01	0.998	LAG	7.84	0.999	LAG	7.84	0.999	LAG
24	FLT_24_SOONER4_PERRY4_138kV	12.96	0.998	LAG	7.87	0.999	LAG	7.92	0.999	LAG
25	FLT_25_SOONER4_MILLERT4_138kV	12.96	0.998	LAG	7.75	0.999	LAG	7.78	0.999	LAG
26	FLT_26_SOONER4_MORISNT4_138kV	15.17	0.997	LAG	9.86	0.999	LAG	9.84	0.999	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	16.14	0.997	LAG	22.8	0.994	LAG	23.62	0.993	LAG
28	FLT_28_G15066_CLEVLND7_345kV	19.27	0.995	LAG	13.81	0.998	LAG	11.53	0.998	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	38.39	0.982	LAG	39.16	0.981	LAG	38.59	0.982	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	11.33	0.998	LAG	5.43	1	LAG	5.58	1	LAG
31	FLT_31_ROSEHIL7_BENTON7_345kV	18.14	0.996	LAG	10.97	0.998	LAG	11.2	0.998	LAG
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	22.02	0.994	LAG	14.31	0.997	LAG	14.22	0.997	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	12.62	0.998	LAG	8.65	0.999	LAG	8.09	0.999	LAG
34	FLT_34_BRECKNR4_SO4TH4_138kV	12.26	0.998	LAG	7.12	0.999	LAG	7.11	0.999	LAG
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	12.23	0.998	LAG	7.08	0.999	LAG	7.06	0.999	LAG
36	FLT_36_BRECKNR4_ENIDINT4_138kV	12.35	0.998	LAG	7.27	0.999	LAG	7.27	0.999	LAG
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	12.36	0.998	LAG	7.19	0.999	LAG	7.17	0.999	LAG
38	FLT_38_SO4TH4_SO4TH2_138_69kV	12.29	0.998	LAG	7.2	0.999	LAG	7.2	0.999	LAG

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-034 POI Ranch Road 345 kV (515576) Power at POI (MW): 200.0	2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.010 pu			2025 Summer Peak POI Voltage = 1.010 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
39	FLT_39_SO4TH4_IMO4_138kV	12.35	0.998	LAG	7.24	0.999	LAG	7.23	0.999	LAG
40	FLT_40_SO4TH4_WAUKOTP4_138kV	12.28	0.998	LAG	7.13	0.999	LAG	7.11	0.999	LAG
41	FLT_41_SO4TH4_FRMNTAP4_138kV	12.32	0.998	LAG	7.19	0.999	LAG	7.17	0.999	LAG
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	12.23	0.998	LAG	7.12	0.999	LAG	7.15	0.999	LAG
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	12.31	0.998	LAG	7.21	0.999	LAG	7.21	0.999	LAG
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	12.33	0.998	LAG	7.14	0.999	LAG	7.12	0.999	LAG
45	FLT_45_G15063_MATHWSN7_345kV	33.18	0.987	LAG	24.76	0.992	LAG	22.4	0.994	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	13.07	0.998	LAG	7.82	0.999	LAG	7.62	0.999	LAG
47	FLT_47_CLEVLND7_TNO7_345kV	28.35	0.99	LAG	21.42	0.994	LAG	20.18	0.995	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	4.07	1	LAG	2.02	1	LAG	1.89	1	LAG
49	FLT_49_UNIONRG6_SUMMIT6_230kV	12.78	0.998	LAG	7.49	0.999	LAG	7.46	0.999	LAG
50	FLT_50_UNIONRG6_MORRIS6_230kV	12.24	0.998	LAG	7.16	0.999	LAG	7.11	0.999	LAG
51	FLT_51_SUMMIT6_MCPHER6_230kV	12.53	0.998	LAG	7.36	0.999	LAG	7.25	0.999	LAG
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	12.62	0.998	LAG	7.31	0.999	LAG	7.23	0.999	LAG
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	11.83	0.998	LAG	7.13	0.999	LAG	7.07	0.999	LAG
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	12.32	0.998	LAG	7.17	0.999	LAG	7.14	0.999	LAG
55	FLT_55_MORRIS6_MCDOWEL6_230kV	12.51	0.998	LAG	7.23	0.999	LAG	7.2	0.999	LAG
56	FLT_56_MORRIS6_SWISVAL6_230kV	12.35	0.998	LAG	7.17	0.999	LAG	7.14	0.999	LAG
57	FLT_57_MORRIS6_MORRIS3_230_115kV	12.23	0.998	LAG	7.12	0.999	LAG	7.11	0.999	LAG
58	FLT_58_MORRIS6_MORRIS7_230_345kV	12.27	0.998	LAG	7.25	0.999	LAG	7.23	0.999	LAG
59	FLT_59_EMPEC7_MORRIS7_345kV	13.39	0.998	LAG	7.64	0.999	LAG	7.54	0.999	LAG
60	FLT_60_EMPEC7_LANG7_345kV	12.22	0.998	LAG	7.24	0.999	LAG	7.23	0.999	LAG
61	FLT_61_EMPEC7_G14001TAP_345kV	15.44	0.997	LAG	9.26	0.999	LAG	8.82	0.999	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	14.91	0.997	LAG	8.53	0.999	LAG	8.19	0.999	LAG
63	FLT_63_MORRIS7_JECN7_345kV	12.87	0.998	LAG	7.22	0.999	LAG	7.17	0.999	LAG
64	FLT_64_MORRIS7_MORRIS6_345_230kV	12.27	0.998	LAG	7.25	0.999	LAG	7.23	0.999	LAG
65	FLT_65_SWISVAL7_WGRDNR7_345kV	13.19	0.998	LAG	7.76	0.999	LAG	7.43	0.999	LAG
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	12.13	0.998	LAG	7.13	0.999	LAG	7.12	0.999	LAG
67	FLT_67_LANG7_LANG3_345_115kV	12.37	0.998	LAG	7.24	0.999	LAG	7.23	0.999	LAG
68	FLT_68_G14001TAP_WICHITA7_345kV	14.28	0.997	LAG	8.43	0.999	LAG	8.23	0.999	LAG
69	FLT_69_SC10BEL4_FARBER4_138kV	12.18	0.998	LAG	8	0.999	LAG	7.94	0.999	LAG
70	FLT_70_SC10BEL4_SUMNER4_138kV	11.58	0.998	LAG	7.07	0.999	LAG	7.23	0.999	LAG
71	FLT_71_FARBER4_ELPASO4_138kV	11.54	0.998	LAG	7.16	0.999	LAG	7.28	0.999	LAG
72	FLT_72_SUMNER4_OXFORD4_138kV	12.08	0.998	LAG	7.09	0.999	LAG	7.05	0.999	LAG
73	FLT_73_SUMNER4_TIMBJCT4_138kV	13.01	0.998	LAG	7.51	0.999	LAG	7.55	0.999	LAG
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	12.28	0.998	LAG	7.17	0.999	LAG	7.16	0.999	LAG

Table D-2: GEN-2015-047 Power Factor Analysis Results

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-047 POI: Sooner 345 kV (514803) **Power at POI (MW): 300.0**	2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.010 pu			2025 Summer Peak POI Voltage = 1.010 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	46.83	0.988	LAG	43.38	0.99	LAG	43.03	0.99	LAG
1	FLT_01_RANCHRD7_OPENSKY7_345kV	48.1	0.987	LAG	46.47	0.988	LAG	45.91	0.988	LAG
2	FLT_02_RANCHRD7_SOONER7_345kV	30.42	0.995	LAG	30.44	0.995	LAG	29.79	0.995	LAG
3	FLT_03_OPENSKY7_G15052_345kV	65.43	0.977	LAG	62.54	0.979	LAG	61.9	0.979	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	56.21	0.983	LAG	52.46	0.985	LAG	52.85	0.985	LAG
5	FLT_05_G16061TAP_WOODRNG7_345kV	53.3	0.984	LAG	49.51	0.986	LAG	49.9	0.986	LAG
6	FLT_06_SOONER7_G15066_345kV	36.69	0.992	LAG	29.03	0.995	LAG	29.05	0.995	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	46.52	0.988	LAG	41.8	0.99	LAG	41.53	0.99	LAG
8	FLT_08_SOONER7_SPRNGCK7_345kV	59.24	0.981	LAG	56.64	0.982	LAG	55.87	0.983	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	48.17	0.987	LAG	44.27	0.989	LAG	44.08	0.989	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	47.19	0.988	LAG	43.49	0.99	LAG	43.13	0.99	LAG
11	FLT_11_THISTLE7_G16005TAP_345kV	47.22	0.988	LAG	43.57	0.989	LAG	43.25	0.99	LAG
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	46.98	0.988	LAG	43.45	0.99	LAG	43.11	0.99	LAG
13	FLT_13_THISTLE7_WWRDEHV7_345kV	46.86	0.988	LAG	43.57	0.989	LAG	43.52	0.989	LAG
14	FLT_14_THISTLE7_THISTLE4_345_138kV	46.87	0.988	LAG	43.3	0.99	LAG	42.95	0.99	LAG
15	FLT_15_WICHITA7_VIOLA7_345kV	59.92	0.98	LAG	55.75	0.983	LAG	46.23	0.988	LAG
16	FLT_16_WICHITA7_RENO7_345kV	50.84	0.986	LAG	45.98	0.988	LAG	45.45	0.989	LAG
17	FLT_17_WICHITA7_BENTON7_345kV	49.52	0.986	LAG	45.13	0.989	LAG	45.88	0.988	LAG
18	FLT_18_WICHITA7_G14001TAP_345kV	47.95	0.987	LAG	44.12	0.989	LAG	43.6	0.989	LAG
19	FLT_19_WICHITA7_EVANSN4_345_138kV	47.34	0.988	LAG	43.05	0.99	LAG	42.64	0.99	LAG
20	FLT_20_WOODRNG7_G15063_345kV	59.69	0.98	LAG	53.51	0.984	LAG	51.74	0.985	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	47.89	0.987	LAG	43.44	0.99	LAG	43.52	0.989	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	48.4	0.987	LAG	44.22	0.989	LAG	43.31	0.99	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	47.7	0.987	LAG	44.17	0.989	LAG	43.82	0.989	LAG
24	FLT_24_SOONER4_PERRY4_138kV	47.78	0.987	LAG	44.31	0.989	LAG	44.04	0.989	LAG
25	FLT_25_SOONER4_MILLERT4_138kV	47.57	0.987	LAG	44.03	0.989	LAG	43.71	0.989	LAG
26	FLT_26_SOONER4_MORISNT4_138kV	50.62	0.986	LAG	46.73	0.988	LAG	46.39	0.988	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	51.31	0.985	LAG	61.74	0.979	LAG	62.42	0.979	LAG
28	FLT_28_G15066_CLEVLND7_345kV	47.01	0.988	LAG	39.33	0.991	LAG	38.92	0.992	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	104.95	0.943	LAG	99.34	0.949	LAG	97.97	0.95	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	46.78	0.988	LAG	43.06	0.99	LAG	42.75	0.99	LAG
31	FLT_31_ROSEHIL7_BENTON7_345kV	49.8	0.986	LAG	45.71	0.988	LAG	46.23	0.988	LAG
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	49.85	0.986	LAG	44.79	0.989	LAG	44.75	0.989	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	49.28	0.987	LAG	45.22	0.989	LAG	44.43	0.989	LAG
34	FLT_34_BRECKNR4_SO4TH4_138kV	46.84	0.988	LAG	43.39	0.99	LAG	43.04	0.99	LAG
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	46.79	0.988	LAG	43.35	0.99	LAG	43	0.99	LAG
36	FLT_36_BRECKNR4_ENIDINT4_138kV	46.94	0.988	LAG	43.54	0.989	LAG	43.2	0.99	LAG
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	46.96	0.988	LAG	43.46	0.99	LAG	43.1	0.99	LAG
38	FLT_38_SO4TH4_SO4TH2_138_69kV	46.87	0.988	LAG	43.47	0.99	LAG	43.13	0.99	LAG
39	FLT_39_SO4TH4_IMO4_138kV	46.95	0.988	LAG	43.51	0.989	LAG	43.16	0.99	LAG
40	FLT_40_SO4TH4_WAUKOTP4_138kV	46.85	0.988	LAG	43.39	0.99	LAG	43.04	0.99	LAG
41	FLT_41_SO4TH4_FRMNTAP4_138kV	46.9	0.988	LAG	43.45	0.99	LAG	43.1	0.99	LAG
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	46.8	0.988	LAG	43.41	0.99	LAG	43.11	0.99	LAG

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-047 POI: Sooner 345 kV (514803) Power at POI (MW): 300.0	2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.010 pu			2025 Summer Peak POI Voltage = 1.010 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	46.89	0.988	LAG	43.48	0.99	LAG	43.14	0.99	LAG
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	46.92	0.988	LAG	43.41	0.99	LAG	43.05	0.99	LAG
45	FLT_45_G15063_MATHWSN7_345kV	78.51	0.967	LAG	63.2	0.978	LAG	60.17	0.98	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	47.78	0.987	LAG	44.18	0.989	LAG	43.65	0.989	LAG
47	FLT_47_CLEVLND7_TNO7_345kV	61.09	0.98	LAG	55.33	0.983	LAG	55.09	0.983	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	37.08	0.992	LAG	32.46	0.994	LAG	31.94	0.994	LAG
49	FLT_49_UNIONRG6_SUMMIT6_230kV	46.89	0.988	LAG	43.4	0.99	LAG	43.07	0.99	LAG
50	FLT_50_UNIONRG6_MORRIS6_230kV	46.92	0.988	LAG	43.45	0.99	LAG	43.07	0.99	LAG
51	FLT_51_SUMMIT6_MCPHER6_230kV	46.91	0.988	LAG	43.44	0.99	LAG	43.06	0.99	LAG
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	46.99	0.988	LAG	43.44	0.99	LAG	43.07	0.99	LAG
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	46.7	0.988	LAG	43.44	0.99	LAG	43.08	0.99	LAG
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	46.86	0.988	LAG	43.41	0.99	LAG	43.05	0.99	LAG
55	FLT_55_MORRIS6_MCDOWEL6_230kV	46.95	0.988	LAG	43.43	0.99	LAG	43.07	0.99	LAG
56	FLT_56_MORRIS6_SWISVAL6_230kV	46.98	0.988	LAG	43.48	0.99	LAG	43.11	0.99	LAG
57	FLT_57_MORRIS6_MORRIS3_230_115kV	46.82	0.988	LAG	43.37	0.99	LAG	43.03	0.99	LAG
58	FLT_58_MORRIS6_MORRIS7_230_345kV	46.84	0.988	LAG	43.43	0.99	LAG	43.09	0.99	LAG
59	FLT_59_EMPEC7_MORRIS7_345kV	47.47	0.988	LAG	43.7	0.989	LAG	43.29	0.99	LAG
60	FLT_60_EMPEC7_LANG7_345kV	46.83	0.988	LAG	43.44	0.99	LAG	43.09	0.99	LAG
61	FLT_61_EMPEC7_G14001TAP_345kV	49.27	0.987	LAG	45.14	0.989	LAG	44.43	0.989	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	49.47	0.986	LAG	45.11	0.989	LAG	44.42	0.989	LAG
63	FLT_63_MORRIS7_JECN7_345kV	47.19	0.988	LAG	43.45	0.99	LAG	43.07	0.99	LAG
64	FLT_64_MORRIS7_MORRIS6_345_230kV	46.84	0.988	LAG	43.43	0.99	LAG	43.09	0.99	LAG
65	FLT_65_SWISVAL7_WGRDNR7_345kV	48.51	0.987	LAG	44.62	0.989	LAG	43.86	0.989	LAG
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	46.76	0.988	LAG	43.39	0.99	LAG	43.04	0.99	LAG
67	FLT_67_LANG7_LANG3_345_115kV	46.89	0.988	LAG	43.44	0.99	LAG	43.09	0.99	LAG
68	FLT_68_G14001TAP_WICHITA7_345kV	47.95	0.987	LAG	44.12	0.989	LAG	43.6	0.989	LAG
69	FLT_69_SC10BEL4_FARBER4_138kV	47.24	0.988	LAG	43.87	0.989	LAG	43.35	0.99	LAG
70	FLT_70_SC10BEL4_SUMNER4_138kV	46.8	0.988	LAG	43.38	0.99	LAG	43.04	0.99	LAG
71	FLT_71_FARBER4_ELPASO4_138kV	46.99	0.988	LAG	43.6	0.989	LAG	43.16	0.99	LAG
72	FLT_72_SUMNER4_OXFORD4_138kV	46.94	0.988	LAG	43.48	0.99	LAG	43.13	0.99	LAG
73	FLT_73_SUMNER4_TIMBJCT4_138kV	47.11	0.988	LAG	43.48	0.99	LAG	43.16	0.99	LAG
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	46.96	0.988	LAG	43.52	0.989	LAG	43.16	0.99	LAG

Table D-3: GEN-2015-052 Power Factor Analysis Results

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-052 POI: Tap on Open Sky to Rosehill 345 kV (560053) **Power at POI (MW): 300.0**	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
0	FLT_00_NoFault	84.27	0.963	LAG	31.32	0.995	LAG	32.12	0.994	LAG
1	FLT_01_RANCHRD7_OPENSKY7_345kV	92.49	0.956	LAG	43.2	0.99	LAG	45.42	0.989	LAG
2	FLT_02_RANCHRD7_SOONER7_345kV	319.9	0.684	LAG	235.42	0.787	LAG	244.38	0.775	LAG
3	FLT_03_OPENSKY7_G15052_345kV	60.06	0.981	LAG	14.12	0.999	LAG	15.56	0.999	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	101	0.948	LAG	50.13	0.986	LAG	54.74	0.984	LAG
5	FLT_05_G16061TAP_WOODRNG7_345kV	97.73	0.951	LAG	46.65	0.988	LAG	51.32	0.986	LAG
6	FLT_06_SOONER7_G15066_345kV	119.56	0.929	LAG	55.37	0.983	LAG	49.51	0.987	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	86.75	0.961	LAG	33	0.994	LAG	33.92	0.994	LAG
8	FLT_08_SOONER7_SPRNGCK7_345kV	123.26	0.925	LAG	67.84	0.975	LAG	68.66	0.975	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	93.79	0.954	LAG	35.41	0.993	LAG	35.27	0.993	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	89.86	0.958	LAG	33.88	0.994	LAG	34.19	0.994	LAG
11	FLT_11_THISTLE7_G16005TAP_345kV	87.38	0.96	LAG	32.8	0.994	LAG	33.63	0.994	LAG
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	85.43	0.962	LAG	31.86	0.994	LAG	32.67	0.994	LAG
13	FLT_13_THISTLE7_WWRDEHV7_345kV	83.8	0.963	LAG	30.09	0.995	LAG	29.82	0.995	LAG
14	FLT_14_THISTLE7_THISTLE4_345_138kV	86.26	0.961	LAG	32.91	0.994	LAG	33.16	0.994	LAG
15	FLT_15_WICHITA7_VIOLA7_345kV	127.67	0.92	LAG	71.23	0.973	LAG	44.96	0.989	LAG
16	FLT_16_WICHITA7_RENO7_345kV	105.67	0.943	LAG	36.91	0.993	LAG	39.81	0.991	LAG
17	FLT_17_WICHITA7_BENTON7_345kV	125.23	0.923	LAG	67.08	0.976	LAG	83.71	0.963	LAG
18	FLT_18_WICHITA7_G14001TAP_345kV	92.9	0.955	LAG	36.58	0.993	LAG	36.88	0.993	LAG
19	FLT_19_WICHITA7_EVANSN4_345_138kV	93.54	0.955	LAG	28.66	0.995	LAG	27.86	0.996	LAG
20	FLT_20_WOODRNG7_G15063_345kV	111.58	0.937	LAG	50.53	0.986	LAG	49.14	0.987	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	99.77	0.949	LAG	30.96	0.995	LAG	29.15	0.995	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	87.06	0.96	LAG	33.07	0.994	LAG	33.27	0.994	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	86.71	0.961	LAG	33.54	0.994	LAG	34.34	0.994	LAG
24	FLT_24_SOONER4_PERRY4_138kV	85.97	0.961	LAG	32.95	0.994	LAG	33.91	0.994	LAG
25	FLT_25_SOONER4_MILLERT4_138kV	86.68	0.961	LAG	33.37	0.994	LAG	34.28	0.994	LAG
26	FLT_26_SOONER4_MORISNT4_138kV	91.15	0.957	LAG	37.13	0.992	LAG	37.96	0.992	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	113.14	0.936	LAG	73.92	0.971	LAG	77.86	0.968	LAG
28	FLT_28_G15066_CLEVLND7_345kV	150.71	0.894	LAG	80.56	0.966	LAG	73.27	0.971	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	122.52	0.926	LAG	104.87	0.944	LAG	105.38	0.943	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	79.26	0.967	LAG	23.73	0.997	LAG	25.23	0.996	LAG
31	FLT_31_ROSEHIL7_BENTON7_345kV	110.08	0.939	LAG	53.9	0.984	LAG	53.9	0.984	LAG
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	131.56	0.916	LAG	68.28	0.975	LAG	75.89	0.969	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	69.46	0.974	LAG	28.04	0.996	LAG	28.43	0.996	LAG
34	FLT_34_BRECKNR4_SO4TH4_138kV	84.31	0.963	LAG	31.35	0.995	LAG	32.15	0.994	LAG
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	84.41	0.963	LAG	31.35	0.995	LAG	32.21	0.994	LAG
36	FLT_36_BRECKNR4_ENIDINT4_138kV	84.49	0.963	LAG	31.61	0.994	LAG	32.45	0.994	LAG
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	84.42	0.963	LAG	31.42	0.995	LAG	32.21	0.994	LAG
38	FLT_38_SO4TH4_SO4TH2_138_69kV	84.32	0.963	LAG	31.48	0.995	LAG	32.3	0.994	LAG
39	FLT_39_SO4TH4_IMO4_138kV	84.43	0.963	LAG	31.56	0.995	LAG	32.38	0.994	LAG
40	FLT_40_SO4TH4_WAUKOTP4_138kV	84.3	0.963	LAG	31.35	0.995	LAG	32.15	0.994	LAG
41	FLT_41_SO4TH4_FRMNTAP4_138kV	84.39	0.963	LAG	31.46	0.995	LAG	32.27	0.994	LAG
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	84.41	0.963	LAG	31.41	0.995	LAG	32.34	0.994	LAG

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
GEN-2015-052 POI: Tap on Open Sky to Rosehill 345 kV (560053) Power at POI (MW): 300.0	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu			
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	84.38	0.963	LAG	31.51	0.995	LAG	32.34	0.994	LAG
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	84.37	0.963	LAG	31.36	0.995	LAG	32.16	0.994	LAG
45	FLT_45_G15063_MATHWSN7_345kV	131.1	0.916	LAG	65.44	0.977	LAG	62.55	0.979	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	85.94	0.961	LAG	32.57	0.994	LAG	32.96	0.994	LAG
47	FLT_47_CLEVLND7_TNO7_345kV	138.01	0.908	LAG	73.44	0.971	LAG	69.87	0.974	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	76.02	0.969	LAG	22.04	0.997	LAG	23.11	0.997	LAG
49	FLT_49_UNIONRG6_SUMMIT6_230kV	86.96	0.96	LAG	33.28	0.994	LAG	33.9	0.994	LAG
50	FLT_50_UNIONRG6_MORRIS6_230kV	83.9	0.963	LAG	31.32	0.995	LAG	32.01	0.994	LAG
51	FLT_51_SUMMIT6_MCPHER6_230kV	85.5	0.962	LAG	32.42	0.994	LAG	32.77	0.994	LAG
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	85.71	0.962	LAG	32.15	0.994	LAG	32.66	0.994	LAG
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	82.22	0.964	LAG	31.13	0.995	LAG	31.71	0.994	LAG
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	84.5	0.963	LAG	31.51	0.995	LAG	32.25	0.994	LAG
55	FLT_55_MORRIS6_MCDOWEL6_230kV	85.28	0.962	LAG	31.74	0.994	LAG	32.48	0.994	LAG
56	FLT_56_MORRIS6_SWISVAL6_230kV	84.18	0.963	LAG	31.21	0.995	LAG	31.99	0.994	LAG
57	FLT_57_MORRIS6_MORRIS3_230_115kV	84.17	0.963	LAG	31.35	0.995	LAG	32.18	0.994	LAG
58	FLT_58_MORRIS6_MORRIS7_230_345kV	84.34	0.963	LAG	31.81	0.994	LAG	32.58	0.994	LAG
59	FLT_59_EMPEC7_MORRIS7_345kV	88.71	0.959	LAG	33.09	0.994	LAG	33.62	0.994	LAG
60	FLT_60_EMPEC7_LANG7_345kV	84.07	0.963	LAG	31.81	0.994	LAG	32.59	0.994	LAG
61	FLT_61_EMPEC7_G14001TAP_345kV	95.48	0.953	LAG	37.67	0.992	LAG	37.28	0.992	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	89.82	0.958	LAG	32.6	0.994	LAG	32.82	0.994	LAG
63	FLT_63_MORRIS7_JECN7_345kV	86.84	0.961	LAG	31.79	0.994	LAG	32.47	0.994	LAG
64	FLT_64_MORRIS7_MORRIS6_345_230kV	84.34	0.963	LAG	31.81	0.994	LAG	32.58	0.994	LAG
65	FLT_65_SWISVAL7_WGRDNR7_345kV	83.15	0.964	LAG	29.82	0.995	LAG	30.74	0.995	LAG
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	83.81	0.963	LAG	31.4	0.995	LAG	32.17	0.994	LAG
67	FLT_67_LANG7_LANG3_345_115kV	84.7	0.962	LAG	31.8	0.994	LAG	32.58	0.994	LAG
68	FLT_68_G14001TAP_WICHITA7_345kV	92.9	0.955	LAG	36.58	0.993	LAG	36.88	0.993	LAG
69	FLT_69_SC10BEL4_FARBER4_138kV	83.96	0.963	LAG	35.37	0.993	LAG	36.29	0.993	LAG
70	FLT_70_SC10BEL4_SUMNER4_138kV	80.58	0.966	LAG	31	0.995	LAG	32.81	0.994	LAG
71	FLT_71_FARBER4_ELPASO4_138kV	81.03	0.965	LAG	31.61	0.994	LAG	33.24	0.994	LAG
72	FLT_72_SUMNER4_OXFORD4_138kV	83.46	0.963	LAG	31.03	0.995	LAG	31.92	0.994	LAG
73	FLT_73_SUMNER4_TIMBJCT4_138kV	87.57	0.96	LAG	33.1	0.994	LAG	34.1	0.994	LAG
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	83.84	0.963	LAG	31.01	0.995	LAG	31.86	0.994	LAG

Table D-4: GEN-2015-062 Power Factor Analysis Results

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-062 POI: Breckenridge 138kV (514815) Power at POI (MW): 4.5	2016 Winter Peak POI Voltage = 1.005 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
1	FLT_01_RANCHRD7_OPENSKY7_345kV	-0.77	0.986	LEAD	-0.82	0.984	LEAD	-0.22	0.999	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	-0.85	0.983	LEAD	-1	0.976	LEAD	-0.44	0.995	LEAD
3	FLT_03_OPENSKY7_G15052_345kV	-0.54	0.993	LEAD	-0.58	0.992	LEAD	0.05	1	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	-0.68	0.989	LEAD	-0.71	0.988	LEAD	-0.09	1	LEAD
5	FLT_05_G16061TAP_WOODRNG7_345kV	-0.57	0.992	LEAD	-0.6	0.991	LEAD	0.03	1	LAG
6	FLT_06_SOONER7_G15066_345kV	-0.37	0.997	LEAD	-0.56	0.992	LEAD	-0.02	1	LEAD
7	FLT_07_SOONER7_SOONER4_345_138kV	-0.6	0.991	LEAD	-0.84	0.983	LEAD	-0.26	0.998	LEAD
8	FLT_08_SOONER7_SPRNGCK7_345kV	0.19	0.999	LAG	-0.03	1	LEAD	0.57	0.992	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	-0.71	0.988	LEAD	-0.8	0.985	LEAD	-0.19	0.999	LEAD
10	FLT_10_G1524G1525T_WICHITA7_345kV	-0.76	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
11	FLT_11_THISTLE7_G16005TAP_345kV	-0.76	0.986	LEAD	-0.84	0.983	LEAD	-0.25	0.998	LEAD
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.25	0.998	LEAD
13	FLT_13_THISTLE7_WWRDEHV7_345kV	-0.78	0.985	LEAD	-0.83	0.983	LEAD	-0.21	0.999	LEAD
14	FLT_14_THISTLE7_THISTLE4_345_138kV	-0.78	0.985	LEAD	-0.86	0.982	LEAD	-0.27	0.998	LEAD
15	FLT_15_WICHITA7_VIOLA7_345kV	0.12	1	LAG	-0.01	1	LEAD	-0.05	1	LEAD
16	FLT_16_WICHITA7_RENO7_345kV	-0.6	0.991	LEAD	-0.74	0.987	LEAD	-0.15	0.999	LEAD
17	FLT_17_WICHITA7_BENTON7_345kV	-0.8	0.985	LEAD	-0.86	0.982	LEAD	-0.25	0.998	LEAD
18	FLT_18_WICHITA7_G14001TAP_345kV	-0.73	0.987	LEAD	-0.82	0.984	LEAD	-0.24	0.999	LEAD
19	FLT_19_WICHITA7_EVANSN4_345_138kV	-0.77	0.986	LEAD	-0.88	0.981	LEAD	-0.28	0.998	LEAD
20	FLT_20_WOODRNG7_G15063_345kV	-0.73	0.987	LEAD	-0.73	0.987	LEAD	-0.16	0.999	LEAD
21	FLT_21_WOODRNG7_HUNTERS7_345kV	0.15	0.999	LAG	-0.17	0.999	LEAD	0.26	0.998	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	-0.85	0.983	LEAD	-0.12	1	LEAD	0.59	0.992	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	-0.61	0.991	LEAD	-0.73	0.987	LEAD	-0.13	1	LEAD
24	FLT_24_SOONER4_PERRY4_138kV	-0.65	0.99	LEAD	-0.68	0.989	LEAD	-0.08	1	LEAD
25	FLT_25_SOONER4_MILLERT4_138kV	-0.63	0.99	LEAD	-0.75	0.986	LEAD	-0.14	1	LEAD
26	FLT_26_SOONER4_MORISNT4_138kV	-0.46	0.995	LEAD	-0.51	0.994	LEAD	0.09	1	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	0.09	1	LAG	0.32	0.997	LAG	0.95	0.978	LAG
28	FLT_28_G15066_CLEVLND7_345kV	0	1	LAG	-0.29	0.998	LEAD	0.24	0.999	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	-0.16	0.999	LEAD	-0.22	0.999	LEAD	0.44	0.995	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	-0.77	0.986	LEAD	-0.86	0.982	LEAD	-0.27	0.998	LEAD
31	FLT_31_ROSEHIL7_BENTON7_345kV	-0.75	0.986	LEAD	-0.82	0.984	LEAD	-0.21	0.999	LEAD
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	-0.72	0.987	LEAD	-0.84	0.983	LEAD	-0.24	0.999	LEAD
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	-0.7	0.988	LEAD	-0.8	0.985	LEAD	-0.23	0.999	LEAD
34	FLT_34_BRECKNR4_SO4TH4_138kV	-0.49	0.994	LEAD	-0.57	0.992	LEAD	-0.02	1	LEAD
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	-1	0.976	LEAD	-0.99	0.977	LEAD	-0.59	0.992	LEAD
36	FLT_36_BRECKNR4_ENIDINT4_138kV	-0.76	0.986	LEAD	-0.88	0.981	LEAD	-0.33	0.997	LEAD
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	-1	0.976	LEAD	-0.89	0.981	LEAD	-0.39	0.996	LEAD
38	FLT_38_SO4TH4_SO4TH2_138_69kV	-0.68	0.989	LEAD	-0.65	0.99	LEAD	-0.04	1	LEAD
39	FLT_39_SO4TH4_IMO4_138kV	-0.72	0.987	LEAD	-0.72	0.987	LEAD	-0.09	1	LEAD
40	FLT_40_SO4TH4_WAUKOTP4_138kV	-0.75	0.986	LEAD	-0.74	0.987	LEAD	-0.13	1	LEAD
41	FLT_41_SO4TH4_FRMNTAP4_138kV	-0.75	0.986	LEAD	-0.78	0.985	LEAD	-0.17	0.999	LEAD
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	-1.03	0.975	LEAD	-0.97	0.978	LEAD	-0.53	0.993	LEAD

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-062 POI: Breckenridge 138kV (514815) Power at POI (MW): 4.5	2016 Winter Peak POI Voltage = 1.005 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	-0.66	0.989	LEAD	-0.78	0.985	LEAD	-0.23	0.999	LEAD
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	-0.9	0.981	LEAD	-0.72	0.987	LEAD	-0.24	0.999	LEAD
45	FLT_45_G15063_MATHWSN7_345kV	-0.36	0.997	LEAD	-0.41	0.996	LEAD	0.12	1	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	-0.75	0.986	LEAD	-0.83	0.983	LEAD	-0.24	0.999	LEAD
47	FLT_47_CLEVLND7_TNO7_345kV	-0.13	1	LEAD	-0.36	0.997	LEAD	0.2	0.999	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	-0.76	0.986	LEAD	-0.85	0.983	LEAD	-0.25	0.998	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.25	0.998	LEAD
50	FLT_50_UNIONRG6_MORRIS6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
51	FLT_51_SUMMIT6_MCPHER6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
55	FLT_55_MORRIS6_MCDOWEL6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
56	FLT_56_MORRIS6_SWISVAL6_230kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
57	FLT_57_MORRIS6_MORRIS3_230_115kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
58	FLT_58_MORRIS6_MORRIS7_230_345kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
59	FLT_59_EMPEC7_MORRIS7_345kV	-0.75	0.986	LEAD	-0.84	0.983	LEAD	-0.25	0.998	LEAD
60	FLT_60_EMPEC7_LANG7_345kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	-0.68	0.989	LEAD	-0.78	0.985	LEAD	-0.21	0.999	LEAD
62	FLT_62_EMPEC7_SWISVAL7_345kV	-0.68	0.989	LEAD	-0.79	0.985	LEAD	-0.21	0.999	LEAD
63	FLT_63_MORRIS7_JECN7_345kV	-0.76	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
64	FLT_64_MORRIS7_MORRIS6_345_230kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
65	FLT_65_SWISVAL7_WGRDNR7_345kV	-0.72	0.987	LEAD	-0.82	0.984	LEAD	-0.24	0.999	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	-0.78	0.985	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
67	FLT_67_LANG7_LANG3_345_115kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	-0.73	0.987	LEAD	-0.82	0.984	LEAD	-0.24	0.999	LEAD
69	FLT_69_SC10BEL4_FARBER4_138kV	-0.56	0.992	LEAD	-0.7	0.988	LEAD	-0.19	0.999	LEAD
70	FLT_70_SC10BEL4_SUMNER4_138kV	-0.66	0.989	LEAD	-0.85	0.983	LEAD	-0.27	0.998	LEAD
71	FLT_71_FARBER4_ELPASO4_138kV	-0.59	0.992	LEAD	-0.74	0.987	LEAD	-0.21	0.999	LEAD
72	FLT_72_SUMNER4_OXFORD4_138kV	-0.69	0.988	LEAD	-0.79	0.985	LEAD	-0.19	0.999	LEAD
73	FLT_73_SUMNER4_TIMBJCT4_138kV	-0.76	0.986	LEAD	-0.84	0.983	LEAD	-0.25	0.998	LEAD
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	-0.77	0.986	LEAD	-0.85	0.983	LEAD	-0.26	0.998	LEAD

Table D-5: GEN-2015-063 Power Factor Analysis Results

DISIS-2015-002-4 Group 08
Leading power factor is absorbing vars; Lagging power factor is providing vars

	GEN-2015-063 POI: Tap on Woodring to Matthewson 345 kV (560055) Power at POI (MW): 300	2016 Winter Peak POI Voltage = 1.005 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	18.97	0.998	LAG	-21.5	0.997	LEAD	-21.8	0.997	LEAD
1	FLT_01_RANCHRD7_OPENSKY7_345kV	19.56	0.998	LAG	-17.69	0.998	LEAD	-18.04	0.998	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	1.35	1	LAG	-40.36	0.991	LEAD	-43.84	0.989	LEAD
3	FLT_03_OPENSKY7_G15052_345kV	45.21	0.989	LAG	8.58	1	LAG	10.19	0.999	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	-3.55	1	LEAD	-37.38	0.992	LEAD	-41.88	0.99	LEAD
5	FLT_05_G16061TAP_WOODRNG7_345kV	6.52	1	LAG	-27.26	0.996	LEAD	-31.83	0.994	LEAD
6	FLT_06_SOONER7_G15066_345kV	67.83	0.975	LAG	15.06	0.999	LAG	9.1	1	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	21.02	0.998	LAG	-21.41	0.997	LEAD	-21.54	0.997	LEAD
8	FLT_08_SOONER7_SPRNGCK7_345kV	108.33	0.94	LAG	51.61	0.985	LAG	49.53	0.987	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	25.57	0.996	LAG	-15.91	0.999	LEAD	-14.36	0.999	LEAD
10	FLT_10_G1524G1525T_WICHITA7_345kV	20.09	0.998	LAG	-21.34	0.997	LEAD	-21.67	0.997	LEAD
11	FLT_11_THISTLE7_G16005TAP_345kV	20.87	0.998	LAG	-20.41	0.998	LEAD	-20.28	0.998	LEAD
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	19.69	0.998	LAG	-21.09	0.998	LEAD	-21.24	0.997	LEAD
13	FLT_13_THISTLE7_WWRDEHV7_345kV	19.09	0.998	LAG	-19.42	0.998	LEAD	-16.35	0.999	LEAD
14	FLT_14_THISTLE7_THISTLE4_345_138kV	19.02	0.998	LAG	-22.3	0.997	LEAD	-22.77	0.997	LEAD
15	FLT_15_WICHITA7_VIOLA7_345kV	122.9	0.925	LAG	78.69	0.967	LAG	6.5	1	LAG
16	FLT_16_WICHITA7_RENO7_345kV	36.61	0.993	LAG	-9.17	1	LEAD	-9.55	0.999	LEAD
17	FLT_17_WICHITA7_BENTON7_345kV	16.81	0.998	LAG	-21.97	0.997	LEAD	-21.36	0.997	LEAD
18	FLT_18_WICHITA7_G14001TAP_345kV	22.93	0.997	LAG	-18.67	0.998	LEAD	-19.68	0.998	LEAD
19	FLT_19_WICHITA7_EVANSN4_345_138kV	20.16	0.998	LAG	-23.33	0.997	LEAD	-24.02	0.997	LEAD
20	FLT_20_WOODRNG7_G15063_345kV	-9.12	1	LEAD	-37.14	0.992	LEAD	-43.5	0.99	LEAD
21	FLT_21_WOODRNG7_HUNTERS7_345kV	3.18	1	LAG	-33.17	0.994	LEAD	-29.49	0.995	LEAD
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	34.13	0.994	LAG	-12.62	0.999	LEAD	-17.21	0.998	LEAD
23	FLT_23_SOONER4_SNRPMPT4_138kV	21.36	0.997	LAG	-19.46	0.998	LEAD	-19.39	0.998	LEAD
24	FLT_24_SOONER4_PERRY4_138kV	22.23	0.997	LAG	-17.65	0.998	LEAD	-17.54	0.998	LEAD
25	FLT_25_SOONER4_MILLERT4_138kV	21.12	0.998	LAG	-19.77	0.998	LEAD	-19.62	0.998	LEAD
26	FLT_26_SOONER4_MORISNT4_138kV	31.15	0.995	LAG	-9.95	0.999	LEAD	-9.84	0.999	LEAD
27	FLT_27_SPRNGCK7_NORTWST7_345kV	100.28	0.948	LAG	100.69	0.948	LAG	102.16	0.946	LAG
28	FLT_28_G15066_CLEVLND7_345kV	105.69	0.943	LAG	41.22	0.991	LAG	35.13	0.993	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	84.07	0.963	LAG	45.55	0.989	LAG	49.38	0.987	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	19.58	0.998	LAG	-22.1	0.997	LEAD	-22.43	0.997	LEAD
31	FLT_31_ROSEHIL7_BENTON7_345kV	21.04	0.998	LAG	-19.4	0.998	LEAD	-18.24	0.998	LEAD
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	23.54	0.997	LAG	-20.41	0.998	LEAD	-20.47	0.998	LEAD
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	27.09	0.996	LAG	-16.25	0.999	LEAD	-17.88	0.998	LEAD
34	FLT_34_BRECKNR4_SO4TH4_138kV	18.86	0.998	LAG	-21.53	0.997	LEAD	-21.85	0.997	LEAD
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	17.56	0.998	LAG	-22.38	0.997	LEAD	-23.11	0.997	LEAD
36	FLT_36_BRECKNR4_ENIDINT4_138kV	19.83	0.998	LAG	-20.15	0.998	LEAD	-20.3	0.998	LEAD
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	20.14	0.998	LAG	-20.64	0.998	LEAD	-21.04	0.998	LEAD
38	FLT_38_SO4TH4_SO4TH2_138_69kV	19.4	0.998	LAG	-20.6	0.998	LEAD	-20.83	0.998	LEAD
39	FLT_39_SO4TH4_IMO4_138kV	20.02	0.998	LAG	-20.31	0.998	LEAD	-20.57	0.998	LEAD
40	FLT_40_SO4TH4_WAUKOTP4_138kV	19.15	0.998	LAG	-21.34	0.997	LEAD	-21.69	0.997	LEAD
41	FLT_41_SO4TH4_FRMNTAP4_138kV	19.62	0.998	LAG	-20.81	0.998	LEAD	-21.12	0.998	LEAD
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	17.49	0.998	LAG	-22.01	0.997	LEAD	-22.35	0.997	LEAD
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	19.41	0.998	LAG	-20.65	0.998	LEAD	-20.83	0.998	LEAD

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-063 POI: Tap on Woodring to Matthewson 345 kV (560055) **Power at POI (MW): 300**	2016 Winter Peak POI Voltage = 1.005 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	19.8	0.998	LAG	-21.14	0.998	LEAD	-21.51	0.997	LEAD
45	FLT_45_G15063_MATHWSN7_345kV	-29.23	0.995	LEAD	-34.83	0.993	LEAD	-31.37	0.995	LEAD
46	FLT_46_MATHWSN7_CIMARON7_345kV	22.74	0.997	LAG	-17.16	0.998	LEAD	-19.98	0.998	LEAD
47	FLT_47_CLEVLND7_TNO7_345kV	85.2	0.962	LAG	29.28	0.995	LAG	25.03	0.997	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	12.55	0.999	LAG	-29.1	0.995	LEAD	-28.95	0.995	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	19.36	0.998	LAG	-21.11	0.998	LEAD	-21.24	0.997	LEAD
50	FLT_50_UNIONRG6_MORRIS6_230kV	19.22	0.998	LAG	-21.28	0.997	LEAD	-21.75	0.997	LEAD
51	FLT_51_SUMMIT6_MCPHER6_230kV	19.36	0.998	LAG	-21.1	0.998	LEAD	-21.54	0.997	LEAD
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	19.74	0.998	LAG	-21.32	0.997	LEAD	-21.7	0.997	LEAD
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	18.53	0.998	LAG	-21.05	0.998	LEAD	-21.34	0.997	LEAD
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	19.09	0.998	LAG	-21.37	0.997	LEAD	-21.72	0.997	LEAD
55	FLT_55_MORRIS6_MCDOWEL6_230kV	19.51	0.998	LAG	-21.25	0.997	LEAD	-21.57	0.997	LEAD
56	FLT_56_MORRIS6_SWISVAL6_230kV	19.57	0.998	LAG	-21.13	0.998	LEAD	-21.54	0.997	LEAD
57	FLT_57_MORRIS6_MORRIS3_230_115kV	18.91	0.998	LAG	-21.54	0.997	LEAD	-21.84	0.997	LEAD
58	FLT_58_MORRIS6_MORRIS7_230_345kV	19.03	0.998	LAG	-21.17	0.998	LEAD	-21.44	0.997	LEAD
59	FLT_59_EMPEC7_MORRIS7_345kV	21.67	0.997	LAG	-20.04	0.998	LEAD	-20.55	0.998	LEAD
60	FLT_60_EMPEC7_LANG7_345kV	18.99	0.998	LAG	-21.21	0.997	LEAD	-21.46	0.997	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	28.59	0.995	LAG	-14.18	0.999	LEAD	-15.9	0.999	LEAD
62	FLT_62_EMPEC7_SWISVAL7_345kV	30.26	0.995	LAG	-14.34	0.999	LEAD	-15.91	0.999	LEAD
63	FLT_63_MORRIS7_JECN7_345kV	20.34	0.998	LAG	-21.26	0.997	LEAD	-21.71	0.997	LEAD
64	FLT_64_MORRIS7_MORRIS6_345_230kV	19.03	0.998	LAG	-21.17	0.998	LEAD	-21.44	0.997	LEAD
65	FLT_65_SWISVAL7_WGRDNR7_345kV	25.91	0.996	LAG	-16.77	0.998	LEAD	-18.67	0.998	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	18.68	0.998	LAG	-21.46	0.997	LEAD	-21.77	0.997	LEAD
67	FLT_67_LANG7_LANG3_345_115kV	19.27	0.998	LAG	-21.21	0.997	LEAD	-21.46	0.997	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	22.93	0.997	LAG	-18.67	0.998	LEAD	-19.68	0.998	LEAD
69	FLT_69_SC10BEL4_FARBER4_138kV	22.44	0.997	LAG	-18.89	0.998	LEAD	-19.88	0.998	LEAD
70	FLT_70_SC10BEL4_SUMNER4_138kV	20.4	0.998	LAG	-21.49	0.997	LEAD	-22.03	0.997	LEAD
71	FLT_71_FARBER4_ELPASO4_138kV	21.52	0.997	LAG	-19.81	0.998	LEAD	-20.53	0.998	LEAD
72	FLT_72_SUMNER4_OXFORD4_138kV	20.23	0.998	LAG	-20.58	0.998	LEAD	-21.05	0.998	LEAD
73	FLT_73_SUMNER4_TIMBJCT4_138kV	19.91	0.998	LAG	-21.22	0.997	LEAD	-21.24	0.997	LEAD
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	19.6	0.998	LAG	-20.84	0.998	LEAD	-21.22	0.997	LEAD

Table D-6: GEN-2015-066 Power Factor Analysis Results

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
GEN-2015-066 POI: Cleveland to Sooner 345 kV (560056) **Power at POI (MW): 248**		2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	54.81	0.977	LAG	8.93	0.999	LAG	6.93	1	LAG
1	FLT_01_RANCHRD7_OPENSKY7_345kV	50.88	0.98	LAG	16.54	0.998	LAG	13.25	0.999	LAG
2	FLT_02_RANCHRD7_SOONER7_345kV	-29.15	0.993	LEAD	-54.29	0.977	LEAD	-56.61	0.975	LEAD
3	FLT_03_OPENSKY7_G15052_345kV	123.18	0.896	LAG	86.24	0.945	LAG	81.48	0.95	LAG
4	FLT_04_SOONER7_G16061TAP_345kV	91.96	0.938	LAG	48.21	0.982	LAG	50.88	0.98	LAG
5	FLT_05_G16061TAP_WOODRNG7_345kV	78.92	0.953	LAG	35.09	0.99	LAG	37.76	0.989	LAG
6	FLT_06_SOONER7_G15066_345kV	21.77	0.996	LAG	41.57	0.986	LAG	57.95	0.974	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	51.29	0.979	LAG	4.95	1	LAG	3.72	1	LAG
8	FLT_08_SOONER7_SPRNGCK7_345kV	123.27	0.896	LAG	79.6	0.952	LAG	73.25	0.959	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	60.56	0.972	LAG	12.8	0.999	LAG	11.38	0.999	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	56.29	0.975	LAG	9.36	0.999	LAG	7.31	1	LAG
11	FLT_11_THISTLE7_G16005TAP_345kV	56.54	0.975	LAG	9.75	0.999	LAG	7.82	1	LAG
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	55.47	0.976	LAG	9.25	0.999	LAG	7.27	1	LAG
13	FLT_13_THISTLE7_WWRDEHV7_345kV	54.96	0.976	LAG	9.77	0.999	LAG	8.99	0.999	LAG
14	FLT_14_THISTLE7_THISTLE4_345_138kV	54.96	0.976	LAG	8.56	0.999	LAG	6.59	1	LAG
15	FLT_15_WICHITA7_VIOLA7_345kV	111.03	0.913	LAG	61.66	0.971	LAG	20.96	0.996	LAG
16	FLT_16_WICHITA7_RENO7_345kV	73.85	0.959	LAG	22.79	0.996	LAG	19.11	0.997	LAG
17	FLT_17_WICHITA7_BENTON7_345kV	64.16	0.968	LAG	16	0.998	LAG	18.5	0.997	LAG
18	FLT_18_WICHITA7_G14001TAP_345kV	58.77	0.973	LAG	11.58	0.999	LAG	8.73	0.999	LAG
19	FLT_19_WICHITA7_EVANSN4_345_138kV	57.05	0.975	LAG	7.3	1	LAG	5.06	1	LAG
20	FLT_20_WOODRNG7_G15063_345kV	114.87	0.908	LAG	56.34	0.975	LAG	47.65	0.982	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	53.15	0.978	LAG	3.84	1	LAG	5.03	1	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	61.98	0.97	LAG	13.87	0.998	LAG	9.5	0.999	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	58.93	0.973	LAG	12.72	0.999	LAG	10.63	0.999	LAG
24	FLT_24_SOONER4_PERRY4_138kV	59.11	0.973	LAG	13.29	0.999	LAG	11.54	0.999	LAG
25	FLT_25_SOONER4_MILLERT4_138kV	58.27	0.974	LAG	12.02	0.999	LAG	10.09	0.999	LAG
26	FLT_26_SOONER4_MORISNT4_138kV	73.42	0.959	LAG	25.88	0.995	LAG	23.67	0.995	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	88	0.943	LAG	95.79	0.933	LAG	93.89	0.935	LAG
28	FLT_28_G15066_CLEVLND7_345kV	-37.64	0.989	LEAD	-90.47	0.94	LEAD	-89.78	0.94	LEAD
29	FLT_29_G15052_ROSEHIL7_345kV	216.31	0.754	LAG	174.13	0.819	LAG	167.61	0.829	LAG
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	54.77	0.977	LAG	7.61	1	LAG	5.77	1	LAG
31	FLT_31_ROSEHIL7_BENTON7_345kV	65.97	0.966	LAG	17.7	0.997	LAG	16.92	0.998	LAG
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	63.13	0.969	LAG	12.42	0.999	LAG	11.61	0.999	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	69.96	0.963	LAG	18.94	0.997	LAG	14.64	0.998	LAG
34	FLT_34_BRECKNR4_SO4TH4_138kV	54.84	0.976	LAG	8.97	0.999	LAG	6.96	1	LAG
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	54.61	0.977	LAG	8.81	0.999	LAG	6.75	1	LAG
36	FLT_36_BRECKNR4_ENIDINT4_138kV	55.28	0.976	LAG	9.6	0.999	LAG	7.65	1	LAG
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	55.31	0.976	LAG	9.26	0.999	LAG	7.22	1	LAG
38	FLT_38_SO4TH4_SO4TH2_138_69kV	54.98	0.976	LAG	9.32	0.999	LAG	7.34	1	LAG
39	FLT_39_SO4TH4_IMO4_138kV	55.28	0.976	LAG	9.47	0.999	LAG	7.48	1	LAG
40	FLT_40_SO4TH4_WAUKOTP4_138kV	54.9	0.976	LAG	8.98	0.999	LAG	6.95	1	LAG
41	FLT_41_SO4TH4_FRMNTAP4_138kV	55.12	0.976	LAG	9.27	0.999	LAG	7.25	1	LAG
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	54.63	0.977	LAG	9.02	0.999	LAG	7.16	1	LAG

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
	GEN-2015-066 POI: Cleveland to Sooner 345 kV (560056) Power at POI (MW): 248	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	55.06	0.976	LAG	9.36	0.999	LAG	7.4	1	LAG
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	55.15	0.976	LAG	9.05	0.999	LAG	7.02	1	LAG
45	FLT_45_G15063_MATHWSN7_345kV	165.86	0.832	LAG	99.38	0.928	LAG	84.93	0.946	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	59.53	0.972	LAG	12.84	0.999	LAG	9.98	0.999	LAG
47	FLT_47_CLEVLND7_TNO7_345kV	107.91	0.917	LAG	60.35	0.972	LAG	58.09	0.974	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	-30.38	0.993	LEAD	-84.54	0.947	LEAD	-87.64	0.943	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	54.68	0.977	LAG	8.56	0.999	LAG	6.68	1	LAG
50	FLT_50_UNIONRG6_MORRIS6_230kV	55.41	0.976	LAG	9.41	0.999	LAG	7.25	1	LAG
51	FLT_51_SUMMIT6_MCPHER6_230kV	55.07	0.976	LAG	9.08	0.999	LAG	6.95	1	LAG
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	55.55	0.976	LAG	9.24	0.999	LAG	7.12	1	LAG
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	54.29	0.977	LAG	9.27	0.999	LAG	7.2	1	LAG
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	54.95	0.976	LAG	9.07	0.999	LAG	7.03	1	LAG
55	FLT_55_MORRIS6_MCDOWEL6_230kV	55.36	0.976	LAG	9.15	0.999	LAG	7.11	1	LAG
56	FLT_56_MORRIS6_SWISVAL6_230kV	55.76	0.976	LAG	9.61	0.999	LAG	7.46	1	LAG
57	FLT_57_MORRIS6_MORRIS3_230_115kV	54.74	0.977	LAG	8.88	0.999	LAG	6.89	1	LAG
58	FLT_58_MORRIS6_MORRIS7_230_345kV	54.78	0.977	LAG	9.15	0.999	LAG	7.14	1	LAG
59	FLT_59_EMPEC7_MORRIS7_345kV	57.76	0.974	LAG	10.48	0.999	LAG	8.15	0.999	LAG
60	FLT_60_EMPEC7_LANG7_345kV	54.8	0.977	LAG	9.2	0.999	LAG	7.22	1	LAG
61	FLT_61_EMPEC7_G14001TAP_345kV	65.93	0.967	LAG	17.56	0.998	LAG	13.67	0.998	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	70.09	0.962	LAG	19.49	0.997	LAG	15.58	0.998	LAG
63	FLT_63_MORRIS7_JECN7_345kV	56.34	0.975	LAG	9.18	0.999	LAG	7	1	LAG
64	FLT_64_MORRIS7_MORRIS6_345_230kV	54.78	0.977	LAG	9.15	0.999	LAG	7.14	1	LAG
65	FLT_65_SWISVAL7_WGRDNR7_345kV	65.54	0.967	LAG	17.11	0.998	LAG	12.62	0.999	LAG
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	54.45	0.977	LAG	8.96	0.999	LAG	6.94	1	LAG
67	FLT_67_LANG7_LANG3_345_115kV	55.12	0.976	LAG	9.2	0.999	LAG	7.22	1	LAG
68	FLT_68_G14001TAP_WICHITA7_345kV	58.77	0.973	LAG	11.58	0.999	LAG	8.73	0.999	LAG
69	FLT_69_SC10BEL4_FARBER4_138kV	56.63	0.975	LAG	10.99	0.999	LAG	8.27	0.999	LAG
70	FLT_70_SC10BEL4_SUMNER4_138kV	54.82	0.977	LAG	8.9	0.999	LAG	6.97	1	LAG
71	FLT_71_FARBER4_ELPASO4_138kV	55.57	0.976	LAG	9.8	0.999	LAG	7.47	1	LAG
72	FLT_72_SUMNER4_OXFORD4_138kV	55.35	0.976	LAG	9.35	0.999	LAG	7.3	1	LAG
73	FLT_73_SUMNER4_TIMBJCT4_138kV	56.1	0.975	LAG	9.39	0.999	LAG	7.48	1	LAG
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	55.61	0.976	LAG	9.83	0.999	LAG	7.75	1	LAG

Table D-7: GEN-2015-069 Power Factor Analysis Results

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
	GEN-2015-069 POI: Union Ridge 230kV (532874) Power at POI (MW): 300	2016 Winter Peak POI Voltage = 1.008 pu			2017 Summer Peak POI Voltage = 1.012 pu			2025 Summer Peak POI Voltage = 1.013 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
0	FLT_00_NoFault	-27.02	0.996	LEAD	-29.95	0.995	LEAD	-29.72	0.995	LEAD
1	FLT_01_RANCHRD7_OPENSKY7_345kV	-26.83	0.996	LEAD	-30.08	0.995	LEAD	-29.85	0.995	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	-17.83	0.998	LEAD	-26.54	0.996	LEAD	-26.26	0.996	LEAD
3	FLT_03_OPENSKY7_G15052_345kV	-27.78	0.996	LEAD	-30.63	0.995	LEAD	-30.6	0.995	LEAD
4	FLT_04_SOONER7_G16061TAP_345kV	-27.28	0.996	LEAD	-30.19	0.995	LEAD	-29.84	0.995	LEAD
5	FLT_05_G16061TAP_WOODRNG7_345kV	-27.24	0.996	LEAD	-30.15	0.995	LEAD	-29.82	0.995	LEAD
6	FLT_06_SOONER7_G15066_345kV	-21.97	0.997	LEAD	-27.55	0.996	LEAD	-28.02	0.996	LEAD
7	FLT_07_SOONER7_SOONER4_345_138kV	-26.95	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
8	FLT_08_SOONER7_SPRNGCK7_345kV	-24.61	0.997	LEAD	-28.7	0.995	LEAD	-28.53	0.996	LEAD
9	FLT_09_G1524G1525T_THISTLE7_345kV	-24.2	0.997	LEAD	-28.26	0.996	LEAD	-28.19	0.996	LEAD
10	FLT_10_G1524G1525T_WICHITA7_345kV	-25.67	0.996	LEAD	-29.27	0.995	LEAD	-29.25	0.995	LEAD
11	FLT_11_THISTLE7_G16005TAP_345kV	-26.15	0.996	LEAD	-29.48	0.995	LEAD	-29.31	0.995	LEAD
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	-26.54	0.996	LEAD	-29.67	0.995	LEAD	-29.48	0.995	LEAD
13	FLT_13_THISTLE7_WWRDEHV7_345kV	-27.02	0.996	LEAD	-30.04	0.995	LEAD	-29.85	0.995	LEAD
14	FLT_14_THISTLE7_THISTLE4_345_138kV	-26.42	0.996	LEAD	-29.27	0.995	LEAD	-29.25	0.995	LEAD
15	FLT_15_WICHITA7_VIOLA7_345kV	-27.18	0.996	LEAD	-30.83	0.995	LEAD	-29.73	0.995	LEAD
16	FLT_16_WICHITA7_RENO7_345kV	-29.4	0.995	LEAD	-14.22	0.999	LEAD	-24.08	0.997	LEAD
17	FLT_17_WICHITA7_BENTON7_345kV	-31.69	0.994	LEAD	-32.41	0.994	LEAD	-32.56	0.994	LEAD
18	FLT_18_WICHITA7_G14001TAP_345kV	-26.1	0.996	LEAD	-30.15	0.995	LEAD	-29.7	0.995	LEAD
19	FLT_19_WICHITA7_EVANSN4_345_138kV	-26.42	0.996	LEAD	-31.16	0.995	LEAD	-30.94	0.995	LEAD
20	FLT_20_WOODRNG7_G15063_345kV	-23.35	0.997	LEAD	-27.98	0.996	LEAD	-28.15	0.996	LEAD
21	FLT_21_WOODRNG7_HUNTERS7_345kV	-17.98	0.998	LEAD	-24.9	0.997	LEAD	-26.91	0.996	LEAD
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	-26.71	0.996	LEAD	-29.73	0.995	LEAD	-29.56	0.995	LEAD
23	FLT_23_SOONER4_SNRPMPT4_138kV	-26.89	0.996	LEAD	-29.92	0.995	LEAD	-29.68	0.995	LEAD
24	FLT_24_SOONER4_PERRY4_138kV	-26.9	0.996	LEAD	-29.88	0.995	LEAD	-29.65	0.995	LEAD
25	FLT_25_SOONER4_MILLERT4_138kV	-26.87	0.996	LEAD	-29.92	0.995	LEAD	-29.68	0.995	LEAD
26	FLT_26_SOONER4_MORISNT4_138kV	-26.45	0.996	LEAD	-29.66	0.995	LEAD	-29.45	0.995	LEAD
27	FLT_27_SPRNGCK7_NORTWST7_345kV	-24.92	0.997	LEAD	-28.29	0.996	LEAD	-28.05	0.996	LEAD
28	FLT_28_G15066_CLEVLND7_345kV	-19.56	0.998	LEAD	-26.33	0.996	LEAD	-27.06	0.996	LEAD
29	FLT_29_G15052_ROSEHIL7_345kV	-26.7	0.996	LEAD	-30.06	0.995	LEAD	-30.44	0.995	LEAD
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	-26.49	0.996	LEAD	-30.08	0.995	LEAD	-29.85	0.995	LEAD
31	FLT_31_ROSEHIL7_BENTON7_345kV	-28.21	0.996	LEAD	-30.54	0.995	LEAD	-30.31	0.995	LEAD
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	-24.05	0.997	LEAD	-28.82	0.995	LEAD	-28.66	0.995	LEAD
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	-25.95	0.996	LEAD	-29.28	0.995	LEAD	-29.22	0.995	LEAD
34	FLT_34_BRECKNR4_SO4TH4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	-27.01	0.996	LEAD	-29.96	0.995	LEAD	-29.71	0.995	LEAD
36	FLT_36_BRECKNR4_ENIDINT4_138kV	-27.01	0.996	LEAD	-29.94	0.995	LEAD	-29.7	0.995	LEAD
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
38	FLT_38_SO4TH4_SO4TH2_138_69kV	-27.02	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
39	FLT_39_SO4TH4_IMO4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
40	FLT_40_SO4TH4_WAUKOTP4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.72	0.995	LEAD
41	FLT_41_SO4TH4_FRMNTAP4_138kV	-27.01	0.996	LEAD	-29.94	0.995	LEAD	-29.71	0.995	LEAD
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
	GEN-2015-069 POI: Union Ridge 230kV (532874) Power at POI (MW): 300	2016 Winter Peak POI Voltage = 1.008 pu			2017 Summer Peak POI Voltage = 1.012 pu			2025 Summer Peak POI Voltage = 1.013 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	-27.02	0.996	LEAD	-29.95	0.995	LEAD	-29.71	0.995	LEAD
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	-27.01	0.996	LEAD	-29.95	0.995	LEAD	-29.72	0.995	LEAD
45	FLT_45_G15063_MATHWSN7_345kV	-21.06	0.998	LEAD	-26.63	0.996	LEAD	-27.07	0.996	LEAD
46	FLT_46_MATHWSN7_CIMARON7_345kV	-26.78	0.996	LEAD	-29.83	0.995	LEAD	-29.63	0.995	LEAD
47	FLT_47_CLEVLND7_TNO7_345kV	-22.08	0.997	LEAD	-27.69	0.996	LEAD	-28.06	0.996	LEAD
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	-26.99	0.996	LEAD	-29.93	0.995	LEAD	-29.66	0.995	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	8.74	1	LAG	-5.11	1	LEAD	-2.25	1	LEAD
50	FLT_50_UNIONRG6_MORRIS6_230kV	-25.33	0.996	LEAD	-16.94	0.998	LEAD	-19.88	0.998	LEAD
51	FLT_51_SUMMIT6_MCPHER6_230kV	-22.31	0.997	LEAD	-27.3	0.996	LEAD	-26.72	0.996	LEAD
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	-16.3	0.999	LEAD	-20.45	0.998	LEAD	-21.34	0.997	LEAD
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	-21.89	0.997	LEAD	-14.22	0.999	LEAD	-12.37	0.999	LEAD
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	-25.86	0.996	LEAD	-28.33	0.996	LEAD	-28.41	0.996	LEAD
55	FLT_55_MORRIS6_MCDOWEL6_230kV	-23.63	0.997	LEAD	-27.33	0.996	LEAD	-27.6	0.996	LEAD
56	FLT_56_MORRIS6_SWISVAL6_230kV	-29.38	0.995	LEAD	-31.41	0.995	LEAD	-31.45	0.995	LEAD
57	FLT_57_MORRIS6_MORRIS3_230_115kV	-25.78	0.996	LEAD	-28.88	0.995	LEAD	-28.91	0.995	LEAD
58	FLT_58_MORRIS6_MORRIS7_230_345kV	-26.62	0.996	LEAD	-25.38	0.996	LEAD	-24.94	0.997	LEAD
59	FLT_59_EMPEC7_MORRIS7_345kV	-25.14	0.997	LEAD	-28.85	0.995	LEAD	-28.92	0.995	LEAD
60	FLT_60_EMPEC7_LANG7_345kV	-26.56	0.996	LEAD	-26.96	0.996	LEAD	-25.41	0.996	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	-25.32	0.996	LEAD	-29.32	0.995	LEAD	-29.36	0.995	LEAD
62	FLT_62_EMPEC7_SWISVAL7_345kV	-8.23	1	LEAD	-18.58	0.998	LEAD	-18.73	0.998	LEAD
63	FLT_63_MORRIS7_JECN7_345kV	-17.12	0.998	LEAD	-26.09	0.996	LEAD	-26.27	0.996	LEAD
64	FLT_64_MORRIS7_MORRIS6_345_230kV	-26.62	0.996	LEAD	-25.38	0.996	LEAD	-24.94	0.997	LEAD
65	FLT_65_SWISVAL7_WGRDNR7_345kV	-28.94	0.995	LEAD	-31.78	0.994	LEAD	-30.91	0.995	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	-29.09	0.995	LEAD	-29.96	0.995	LEAD	-29.71	0.995	LEAD
67	FLT_67_LANG7_LANG3_345_115kV	-24.21	0.997	LEAD	-26.99	0.996	LEAD	-25.45	0.996	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	-26.1	0.996	LEAD	-30.15	0.995	LEAD	-29.7	0.995	LEAD
69	FLT_69_SC10BEL4_FARBER4_138kV	-27.22	0.996	LEAD	-29.87	0.995	LEAD	-29.6	0.995	LEAD
70	FLT_70_SC10BEL4_SUMNER4_138kV	-27.3	0.996	LEAD	-29.96	0.995	LEAD	-29.71	0.995	LEAD
71	FLT_71_FARBER4_ELPASO4_138kV	-27.46	0.996	LEAD	-30	0.995	LEAD	-29.69	0.995	LEAD
72	FLT_72_SUMNER4_OXFORD4_138kV	-27.16	0.996	LEAD	-29.99	0.995	LEAD	-29.79	0.995	LEAD
73	FLT_73_SUMNER4_TIMBJCT4_138kV	-26.69	0.996	LEAD	-29.89	0.995	LEAD	-29.63	0.995	LEAD
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	-37.09	0.992	LEAD	-41.18	0.991	LEAD	-41.12	0.991	LEAD

Table D-8: GEN-2015-073 Power Factor Analysis Results

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-073 POI: Emporia/Lang 345kV (532768) **Power at POI (MW): 300**	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
0	FLT_00_NoFault	16.67	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
1	FLT_01_RANCHRD7_OPENSKY7_345kV	16.76	0.997	LAG	-0.99	1	LEAD	0.8	1	LAG
2	FLT_02_RANCHRD7_SOONER7_345kV	20.13	0.995	LAG	1.07	1	LAG	2.65	1	LAG
3	FLT_03_OPENSKY7_G15052_345kV	15.58	0.997	LAG	-1.93	1	LEAD	-0.06	1	LEAD
4	FLT_04_SOONER7_G16061TAP_345kV	16.62	0.997	LAG	-0.94	1	LEAD	0.8	1	LAG
5	FLT_05_G16061TAP_WOODRNG7_345kV	16.62	0.997	LAG	-0.94	1	LEAD	0.8	1	LAG
6	FLT_06_SOONER7_G15066_345kV	19.11	0.995	LAG	0.71	1	LAG	2.19	1	LAG
7	FLT_07_SOONER7_SOONER4_345_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
8	FLT_08_SOONER7_SPRNGCK7_345kV	17.51	0.996	LAG	-0.34	1	LEAD	1.33	1	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	17.27	0.996	LAG	-0.48	1	LEAD	1.31	1	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	16.79	0.996	LAG	-0.84	1	LEAD	0.92	1	LAG
11	FLT_11_THISTLE7_G16005TAP_345kV	16.84	0.996	LAG	-0.8	1	LEAD	0.95	1	LAG
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	16.75	0.997	LAG	-0.84	1	LEAD	0.92	1	LAG
13	FLT_13_THISTLE7_WWRDEHV7_345kV	16.74	0.997	LAG	-0.77	1	LEAD	1.06	1	LAG
14	FLT_14_THISTLE7_THISTLE4_345_138kV	16.64	0.997	LAG	-0.91	1	LEAD	0.87	1	LAG
15	FLT_15_WICHITA7_VIOLA7_345kV	15.1	0.997	LAG	-2.29	1	LEAD	0.46	1	LAG
16	FLT_16_WICHITA7_RENO7_345kV	13.13	0.998	LAG	-1.96	1	LEAD	-1.14	1	LEAD
17	FLT_17_WICHITA7_BENTON7_345kV	16.42	0.997	LAG	-0.93	1	LEAD	0.79	1	LAG
18	FLT_18_WICHITA7_G14001TAP_345kV	15.03	0.997	LAG	-2.12	1	LEAD	-0.27	1	LEAD
19	FLT_19_WICHITA7_EVANSN4_345_138kV	16.85	0.996	LAG	-0.99	1	LEAD	0.78	1	LAG
20	FLT_20_WOODRNG7_G15063_345kV	17.93	0.996	LAG	-0.08	1	LEAD	1.53	1	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	19.29	0.995	LAG	0.78	1	LAG	2.04	1	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	16.76	0.997	LAG	-0.8	1	LEAD	0.96	1	LAG
23	FLT_23_SOONER4_SNRPMPT4_138kV	16.7	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
24	FLT_24_SOONER4_PERRY4_138kV	16.72	0.997	LAG	-0.84	1	LEAD	0.92	1	LAG
25	FLT_25_SOONER4_MILLERT4_138kV	16.7	0.997	LAG	-0.89	1	LEAD	0.88	1	LAG
26	FLT_26_SOONER4_MORISNT4_138kV	16.92	0.996	LAG	-0.7	1	LEAD	1.05	1	LAG
27	FLT_27_SPRNGCK7_NORTWST7_345kV	17.45	0.996	LAG	-0.19	1	LEAD	1.49	1	LAG
28	FLT_28_G15066_CLEVLND7_345kV	20.04	0.995	LAG	1.41	1	LAG	2.81	1	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	14.74	0.997	LAG	-2.65	1	LEAD	-0.74	1	LEAD
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	16.76	0.997	LAG	-0.92	1	LEAD	0.85	1	LAG
31	FLT_31_ROSEHIL7_BENTON7_345kV	16.53	0.997	LAG	-0.99	1	LEAD	0.73	1	LAG
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	17.87	0.996	LAG	0.03	1	LAG	1.75	1	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	17.48	0.996	LAG	-0.38	1	LEAD	1.31	1	LAG
34	FLT_34_BRECKNR4_SO4TH4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
36	FLT_36_BRECKNR4_ENIDINT4_138kV	16.67	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
38	FLT_38_SO4TH4_SO4TH2_138_69kV	16.67	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
39	FLT_39_SO4TH4_IMO4_138kV	16.67	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
40	FLT_40_SO4TH4_WAUKOTP4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
41	FLT_41_SO4TH4_FRMNTAP4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.89	1	LAG
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	16.67	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-073 POI: Emporia/Lang 345kV (532768) Power at POI (MW): 300	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.0 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	16.68	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
45	FLT_45_G15063_MATHWSN7_345kV	18.58	0.996	LAG	0.35	1	LAG	1.9	1	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	16.78	0.997	LAG	-0.81	1	LEAD	0.95	1	LAG
47	FLT_47_CLEVLND7_TNO7_345kV	18.79	0.996	LAG	0.42	1	LAG	2	1	LAG
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	16.78	0.997	LAG	-0.78	1	LEAD	1.01	1	LAG
49	FLT_49_UNIONRG6_SUMMIT6_230kV	24.58	0.993	LAG	6.03	1	LAG	8.14	0.999	LAG
50	FLT_50_UNIONRG6_MORRIS6_230kV	17.97	0.996	LAG	0.23	1	LAG	2.41	1	LAG
51	FLT_51_SUMMIT6_MCPHER6_230kV	17.2	0.996	LAG	-0.38	1	LEAD	1.33	1	LAG
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	17.64	0.996	LAG	-0.21	1	LEAD	1.5	1	LAG
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	16.58	0.997	LAG	-0.02	1	LEAD	1.83	1	LAG
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	16.86	0.996	LAG	-0.65	1	LEAD	1.09	1	LAG
55	FLT_55_MORRIS6_MCDOWEL6_230kV	17.23	0.996	LAG	-0.43	1	LEAD	1.15	1	LAG
56	FLT_56_MORRIS6_SWISVAL6_230kV	18.23	0.996	LAG	0.48	1	LAG	2.22	1	LAG
57	FLT_57_MORRIS6_MORRIS3_230_115kV	16.37	0.997	LAG	-0.27	1	LEAD	1.73	1	LAG
58	FLT_58_MORRIS6_MORRIS7_230_345kV	14.86	0.997	LAG	0.88	1	LAG	2.69	1	LAG
59	FLT_59_EMPEC7_MORRIS7_345kV	34.31	0.986	LAG	18.9	0.996	LAG	20.01	0.995	LAG
60	FLT_60_EMPEC7_LANG7_345kV	12.34	0.998	LAG	-2.28	1	LEAD	-1	1	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	16.67	0.997	LAG	-0.88	1	LEAD	0.88	1	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	23.95	0.993	LAG	9.67	0.999	LAG	10.51	0.999	LAG
63	FLT_63_MORRIS7_JECN7_345kV	27.36	0.991	LAG	7.21	0.999	LAG	8.45	0.999	LAG
64	FLT_64_MORRIS7_MORRIS6_345_230kV	14.86	0.997	LAG	0.88	1	LAG	2.69	1	LAG
65	FLT_65_SWISVAL7_WGRDNR7_345kV	13.98	0.998	LAG	-4.05	1	LEAD	-1.19	1	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	14.64	0.997	LAG	-0.45	1	LEAD	1.15	1	LAG
67	FLT_67_LANG7_LANG3_345_115kV	12.99	0.998	LAG	-2.33	1	LEAD	-1.06	1	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	15.03	0.997	LAG	-2.12	1	LEAD	-0.27	1	LEAD
69	FLT_69_SC10BEL4_FARBER4_138kV	16.47	0.997	LAG	-1	1	LEAD	0.84	1	LAG
70	FLT_70_SC10BEL4_SUMNER4_138kV	16.64	0.997	LAG	-0.87	1	LEAD	0.89	1	LAG
71	FLT_71_FARBER4_ELPASO4_138kV	16.46	0.997	LAG	-0.99	1	LEAD	0.84	1	LAG
72	FLT_72_SUMNER4_OXFORD4_138kV	16.59	0.997	LAG	-0.94	1	LEAD	0.84	1	LAG
73	FLT_73_SUMNER4_TIMBJCT4_138kV	16.74	0.997	LAG	-0.87	1	LEAD	0.89	1	LAG
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	16.44	0.997	LAG	-1.25	1	LEAD	0.54	1	LAG

Table D-9: GEN-2015-083 Power Factor Analysis Results

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-083 POI Belle Plain 138kV (533063) **Power at POI (MW): 125**	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.002 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
0	FLT_00_NoFault	7.67	0.998	LAG	-19.07	0.988	LEAD	-18.04	0.99	LEAD
1	FLT_01_RANCHRD7_OPENSKY7_345kV	8.7	0.998	LAG	-18.93	0.989	LEAD	-17.75	0.99	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	20.83	0.986	LAG	-13.6	0.994	LEAD	-14.92	0.993	LEAD
3	FLT_03_OPENSKY7_G15052_345kV	10.92	0.996	LAG	-18.14	0.99	LEAD	-16.52	0.991	LEAD
4	FLT_04_SOONER7_G16061TAP_345kV	8.59	0.998	LAG	-18.08	0.99	LEAD	-16.83	0.991	LEAD
5	FLT_05_G16061TAP_WOODRNG7_345kV	8.52	0.998	LAG	-18.18	0.989	LEAD	-16.8	0.991	LEAD
6	FLT_06_SOONER7_G15066_345kV	16.3	0.991	LAG	-14.94	0.993	LEAD	-14.3	0.993	LEAD
7	FLT_07_SOONER7_SOONER4_345_138kV	8.61	0.998	LAG	-19.03	0.988	LEAD	-18.03	0.99	LEAD
8	FLT_08_SOONER7_SPRNGCK7_345kV	14.09	0.994	LAG	-15.45	0.992	LEAD	-13.39	0.994	LEAD
9	FLT_09_G1524G1525T_THISTLE7_345kV	10.92	0.996	LAG	-18.29	0.989	LEAD	-17.13	0.991	LEAD
10	FLT_10_G1524G1525T_WICHITA7_345kV	9.84	0.997	LAG	-18.49	0.989	LEAD	-17.39	0.99	LEAD
11	FLT_11_THISTLE7_G16005TAP_345kV	8.85	0.997	LAG	-18.69	0.989	LEAD	-17.53	0.99	LEAD
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	8.11	0.998	LAG	-18.93	0.989	LEAD	-17.86	0.99	LEAD
13	FLT_13_THISTLE7_WWRDEHV7_345kV	7.47	0.998	LAG	-19.39	0.988	LEAD	-18.78	0.989	LEAD
14	FLT_14_THISTLE7_THISTLE4_345_138kV	8.38	0.998	LAG	-18.78	0.989	LEAD	-17.14	0.991	LEAD
15	FLT_15_WICHITA7_VIOLA7_345kV	25.09	0.98	LAG	-8.61	0.998	LEAD	-12.57	0.995	LEAD
16	FLT_16_WICHITA7_RENO7_345kV	14.99	0.993	LAG	-17.8	0.99	LEAD	-15.72	0.992	LEAD
17	FLT_17_WICHITA7_BENTON7_345kV	16.91	0.991	LAG	-11.04	0.996	LEAD	-13.59	0.994	LEAD
18	FLT_18_WICHITA7_G14001TAP_345kV	10.89	0.996	LAG	-17.93	0.99	LEAD	-16.57	0.991	LEAD
19	FLT_19_WICHITA7_EVANSN4_345_138kV	14.85	0.993	LAG	-19.44	0.988	LEAD	-19.33	0.988	LEAD
20	FLT_20_WOODRNG7_G15063_345kV	13.98	0.994	LAG	-16.31	0.991	LEAD	-14.61	0.993	LEAD
21	FLT_21_WOODRNG7_HUNTERS7_345kV	18.41	0.989	LAG	-15.99	0.992	LEAD	-13.74	0.994	LEAD
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	7.62	0.998	LAG	-19.2	0.988	LEAD	-18.21	0.989	LEAD
23	FLT_23_SOONER4_SNRPMPT4_138kV	10.09	0.997	LAG	-17.72	0.99	LEAD	-16.4	0.991	LEAD
24	FLT_24_SOONER4_PERRY4_138kV	8.11	0.998	LAG	-18.77	0.989	LEAD	-17.61	0.99	LEAD
25	FLT_25_SOONER4_MILLERT4_138kV	10.78	0.996	LAG	-17.23	0.991	LEAD	-15.74	0.992	LEAD
26	FLT_26_SOONER4_MORISNT4_138kV	9.51	0.997	LAG	-17.97	0.99	LEAD	-16.64	0.991	LEAD
27	FLT_27_SPRNGCK7_NORTWST7_345kV	13.05	0.995	LAG	-14.46	0.993	LEAD	-11.67	0.996	LEAD
28	FLT_28_G15066_CLEVLND7_345kV	21.67	0.985	LAG	-12.24	0.995	LEAD	-11.43	0.996	LEAD
29	FLT_29_G15052_ROSEHIL7_345kV	21.63	0.985	LAG	-11.2	0.996	LEAD	-8.63	0.998	LEAD
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	15.82	0.992	LAG	-19.53	0.988	LEAD	-19.29	0.988	LEAD
31	FLT_31_ROSEHIL7_BENTON7_345kV	12.18	0.995	LAG	-15.35	0.992	LEAD	-13.93	0.994	LEAD
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	19.83	0.987	LAG	-12.46	0.995	LEAD	-14.69	0.993	LEAD
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	5.76	0.999	LAG	-18.62	0.989	LEAD	-17.78	0.99	LEAD
34	FLT_34_BRECKNR4_SO4TH4_138kV	7.75	0.998	LAG	-19.02	0.988	LEAD	-17.98	0.99	LEAD
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	8.3	0.998	LAG	-18.72	0.989	LEAD	-17.51	0.99	LEAD
36	FLT_36_BRECKNR4_ENIDINT4_138kV	7.76	0.998	LAG	-18.99	0.989	LEAD	-17.91	0.99	LEAD
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	7.66	0.998	LAG	-19.09	0.988	LEAD	-18.05	0.99	LEAD
38	FLT_38_SO4TH4_SO4TH2_138_69kV	7.65	0.998	LAG	-19.05	0.988	LEAD	-18	0.99	LEAD
39	FLT_39_SO4TH4_IMO4_138kV	7.68	0.998	LAG	-19.05	0.988	LEAD	-17.98	0.99	LEAD
40	FLT_40_SO4TH4_WAUKOTP4_138kV	7.68	0.998	LAG	-19.07	0.988	LEAD	-18.03	0.99	LEAD
41	FLT_41_SO4TH4_FRMNTAP4_138kV	7.67	0.998	LAG	-19.06	0.988	LEAD	-18.02	0.99	LEAD
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	8.27	0.998	LAG	-18.75	0.989	LEAD	-17.53	0.99	LEAD

	DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars									
	GEN-2015-083 POI Belle Plain 138kV (533063) **Power at POI (MW): 125**	2016 Winter Peak POI Voltage = 1.0 pu			2017 Summer Peak POI Voltage = 1.0 pu			2025 Summer Peak POI Voltage = 1.002 pu		
	Contingency Name	**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**		**Mvars at POI**	**Power Factor**	
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	7.72	0.998	LAG	-19.02	0.988	LEAD	-17.95	0.99	LEAD
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	7.65	0.998	LAG	-19.09	0.988	LEAD	-18.06	0.99	LEAD
45	FLT_45_G15063_MATHWSN7_345kV	18.37	0.989	LAG	-14.23	0.994	LEAD	-11.87	0.995	LEAD
46	FLT_46_MATHWSN7_CIMARON7_345kV	7.98	0.998	LAG	-18.93	0.989	LEAD	-17.93	0.99	LEAD
47	FLT_47_CLEVLND7_TNO7_345kV	17.8	0.99	LAG	-14.18	0.994	LEAD	-13.04	0.995	LEAD
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	7.55	0.998	LAG	-19.23	0.988	LEAD	-18.2	0.989	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	8.8	0.998	LAG	-18.54	0.989	LEAD	-17.42	0.99	LEAD
50	FLT_50_UNIONRG6_MORRIS6_230kV	7.46	0.998	LAG	-19.1	0.988	LEAD	-18.1	0.99	LEAD
51	FLT_51_SUMMIT6_MCPHER6_230kV	8.19	0.998	LAG	-18.78	0.989	LEAD	-17.8	0.99	LEAD
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	8.21	0.998	LAG	-18.87	0.989	LEAD	-17.87	0.99	LEAD
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	6.88	0.998	LAG	-19.12	0.988	LEAD	-18.17	0.989	LEAD
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	7.75	0.998	LAG	-19.03	0.988	LEAD	-18	0.99	LEAD
55	FLT_55_MORRIS6_MCDOWEL6_230kV	8.04	0.998	LAG	-18.98	0.989	LEAD	-17.93	0.99	LEAD
56	FLT_56_MORRIS6_SWISVAL6_230kV	7.55	0.998	LAG	-19.13	0.988	LEAD	-18.11	0.99	LEAD
57	FLT_57_MORRIS6_MORRIS3_230_115kV	7.63	0.998	LAG	-19.06	0.988	LEAD	-18.02	0.99	LEAD
58	FLT_58_MORRIS6_MORRIS7_230_345kV	7.7	0.998	LAG	-18.95	0.989	LEAD	-17.89	0.99	LEAD
59	FLT_59_EMPEC7_MORRIS7_345kV	9.15	0.997	LAG	-18.71	0.989	LEAD	-17.63	0.99	LEAD
60	FLT_60_EMPEC7_LANG7_345kV	7.58	0.998	LAG	-18.91	0.989	LEAD	-17.85	0.99	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	11.21	0.996	LAG	-17.92	0.99	LEAD	-16.69	0.991	LEAD
62	FLT_62_EMPEC7_SWISVAL7_345kV	8.57	0.998	LAG	-19.17	0.988	LEAD	-18.18	0.989	LEAD
63	FLT_63_MORRIS7_JECN7_345kV	8.49	0.998	LAG	-18.99	0.989	LEAD	-17.95	0.99	LEAD
64	FLT_64_MORRIS7_MORRIS6_345_230kV	7.7	0.998	LAG	-18.95	0.989	LEAD	-17.89	0.99	LEAD
65	FLT_65_SWISVAL7_WGRDNR7_345kV	6.43	0.999	LAG	-19.7	0.988	LEAD	-18.73	0.989	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	7.51	0.998	LAG	-19.06	0.988	LEAD	-18.03	0.99	LEAD
67	FLT_67_LANG7_LANG3_345_115kV	7.86	0.998	LAG	-18.91	0.989	LEAD	-17.85	0.99	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	10.89	0.996	LAG	-17.93	0.99	LEAD	-16.57	0.991	LEAD
69	FLT_69_SC10BEL4_FARBER4_138kV	22.48	0.984	LAG	-4.46	0.999	LEAD	-13.34	0.994	LEAD
70	FLT_70_SC10BEL4_SUMNER4_138kV	-16.69	0.991	LEAD	-18.79	0.989	LEAD	-10.42	0.997	LEAD
71	FLT_71_FARBER4_ELPASO4_138kV	23.73	0.982	LAG	0	1	LAG	-8.14	0.998	LEAD
72	FLT_72_SUMNER4_OXFORD4_138kV	-0.84	1	LEAD	-25.14	0.98	LEAD	-23.45	0.983	LEAD
73	FLT_73_SUMNER4_TIMBJCT4_138kV	2.62	1	LAG	-13.96	0.994	LEAD	-12.54	0.995	LEAD
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	7.42	0.998	LAG	-19.18	0.988	LEAD	-18.17	0.989	LEAD

Table D-10: GEN-2015-090 Power Factor Analysis Results

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
GEN-2015-090 POI: Tap on Wichita to Thistle 345kV (560033) 345kV) **Power at POI (MW): 220**		2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.009 pu			2025 Summer Peak POI Voltage = 1.009 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
0	FLT_00_NoFault	-6.65	1	LEAD	-8.02	0.999	LEAD	-7.25	0.999	LEAD
1	FLT_01_RANCHRD7_OPENSKY7_345kV	-5.65	1	LEAD	-8.13	0.999	LEAD	-7.65	0.999	LEAD
2	FLT_02_RANCHRD7_SOONER7_345kV	27.36	0.992	LAG	8.15	0.999	LAG	14.13	0.998	LAG
3	FLT_03_OPENSKY7_G15052_345kV	-5.03	1	LEAD	-7.88	0.999	LEAD	-9.74	0.999	LEAD
4	FLT_04_SOONER7_G16061TAP_345kV	-7.1	0.999	LEAD	-8.76	0.999	LEAD	-7.13	0.999	LEAD
5	FLT_05_G16061TAP_WOODRNG7_345kV	-6.87	1	LEAD	-8.5	0.999	LEAD	-6.91	1	LEAD
6	FLT_06_SOONER7_G15066_345kV	5.58	1	LAG	-0.76	1	LEAD	-1.7	1	LEAD
7	FLT_07_SOONER7_SOONER4_345_138kV	-6.29	1	LEAD	-8.03	0.999	LEAD	-7.24	0.999	LEAD
8	FLT_08_SOONER7_SPRNGCK7_345kV	3.08	1	LAG	-0.87	1	LEAD	1.57	1	LAG
9	FLT_09_G1524G1525T_THISTLE7_345kV	11.19	0.999	LAG	7.71	0.999	LAG	6.66	1	LAG
10	FLT_10_G1524G1525T_WICHITA7_345kV	-11.22	0.999	LEAD	-13.58	0.998	LEAD	-11.04	0.999	LEAD
11	FLT_11_THISTLE7_G16005TAP_345kV	-1.37	1	LEAD	-3.11	1	LEAD	-2.06	1	LEAD
12	FLT_12_G16005TAP_CLARKCOUNTY7_345kV	-4.66	1	LEAD	-6.21	1	LEAD	-5.38	1	LEAD
13	FLT_13_THISTLE7_WWRDEHV7_345kV	-7.5	0.999	LEAD	-10.41	0.999	LEAD	-11.77	0.999	LEAD
14	FLT_14_THISTLE7_THISTLE4_345_138kV	-4.37	1	LEAD	-7.48	0.999	LEAD	-7.48	0.999	LEAD
15	FLT_15_WICHITA7_VIOLA7_345kV	4.51	1	LAG	-3.45	1	LEAD	-2.88	1	LEAD
16	FLT_16_WICHITA7_RENO7_345kV	16.12	0.997	LAG	-0.11	1	LEAD	8.04	0.999	LAG
17	FLT_17_WICHITA7_BENTON7_345kV	-30.89	0.99	LEAD	-25.9	0.993	LEAD	-29.67	0.991	LEAD
18	FLT_18_WICHITA7_G14001TAP_345kV	3.37	1	LAG	2.37	1	LAG	2.19	1	LAG
19	FLT_19_WICHITA7_EVANSN4_345_138kV	-7.43	0.999	LEAD	-17.65	0.997	LEAD	-18.04	0.997	LEAD
20	FLT_20_WOODRNG7_G15063_345kV	6.12	1	LAG	1.92	1	LAG	2.7	1	LAG
21	FLT_21_WOODRNG7_HUNTERS7_345kV	25.26	0.993	LAG	17.33	0.997	LAG	8.98	0.999	LAG
22	FLT_22_WOODRNG7_WOODRNG4_345_138kV	-5.46	1	LEAD	-7.01	0.999	LEAD	-6.44	1	LEAD
23	FLT_23_SOONER4_SNRPMPT4_138kV	-6.02	1	LEAD	-7.76	0.999	LEAD	-6.96	0.999	LEAD
24	FLT_24_SOONER4_PERRY4_138kV	-6.25	1	LEAD	-7.7	0.999	LEAD	-6.85	1	LEAD
25	FLT_25_SOONER4_MILLERT4_138kV	-5.93	1	LEAD	-7.74	0.999	LEAD	-6.92	1	LEAD
26	FLT_26_SOONER4_MORISNT4_138kV	-4.88	1	LEAD	-6.8	1	LEAD	-5.92	1	LEAD
27	FLT_27_SPRNGCK7_NORTWST7_345kV	1.71	1	LAG	1.69	1	LAG	5.26	1	LAG
28	FLT_28_G15066_CLEVLND7_345kV	12.78	0.998	LAG	3.51	1	LAG	2.14	1	LAG
29	FLT_29_G15052_ROSEHIL7_345kV	5.2	1	LAG	-0.41	1	LEAD	-4.78	1	LEAD
30	FLT_30_ROSEHIL7_ROSEHIL4_345_138kV	-4.3	1	LEAD	-8.79	0.999	LEAD	-8.14	0.999	LEAD
31	FLT_31_ROSEHIL7_BENTON7_345kV	-11.02	0.999	LEAD	-10.35	0.999	LEAD	-10.01	0.999	LEAD
32	FLT_32_ROSEHIL7_WOLFCRK7_345kV	6.81	1	LAG	-0.92	1	LEAD	0.44	1	LAG
33	FLT_33_ROSEHIL7_LATHAMS7_345kV	-7.16	0.999	LEAD	-6.71	1	LEAD	-5.92	1	LEAD
34	FLT_34_BRECKNR4_SO4TH4_138kV	-6.64	1	LEAD	-8.02	0.999	LEAD	-7.24	0.999	LEAD
35	FLT_35_BRECKNR4_BUNCHCK4_138kV	-6.61	1	LEAD	-8.04	0.999	LEAD	-7.23	0.999	LEAD
36	FLT_36_BRECKNR4_ENIDINT4_138kV	-6.57	1	LEAD	-7.91	0.999	LEAD	-7.11	0.999	LEAD
37	FLT_37_BRECKNR4_PLNSMEN4_138kV	-6.6	1	LEAD	-7.99	0.999	LEAD	-7.22	0.999	LEAD
38	FLT_38_SO4TH4_SO4TH2_138_69kV	-6.65	1	LEAD	-7.98	0.999	LEAD	-7.19	0.999	LEAD
39	FLT_39_SO4TH4_IMO4_138kV	-6.62	1	LEAD	-7.95	0.999	LEAD	-7.16	0.999	LEAD
40	FLT_40_SO4TH4_WAUKOTP4_138kV	-6.63	1	LEAD	-8.01	0.999	LEAD	-7.24	0.999	LEAD
41	FLT_41_SO4TH4_FRMNTAP4_138kV	-6.6	1	LEAD	-7.96	0.999	LEAD	-7.19	0.999	LEAD
42	FLT_42_BUNCHCK4_BLLNGTP4_138kV	-6.62	1	LEAD	-8.03	0.999	LEAD	-7.18	0.999	LEAD
43	FLT_43_ENIDINT4_NRTHSTR4_138kV	-6.63	1	LEAD	-7.96	0.999	LEAD	-7.17	0.999	LEAD

DISIS-2015-002-4 Group 08 Leading power factor is absorbing vars; Lagging power factor is providing vars										
	GEN-2015-090 POI: Tap on Wichita to Thistle 345kV (560033) 345kV) Power at POI (MW): 220	2016 Winter Peak POI Voltage = 1.007 pu			2017 Summer Peak POI Voltage = 1.009 pu			2025 Summer Peak POI Voltage = 1.009 pu		
	Contingency Name	Mvars at POI	Power Factor		Mvars at POI	Power Factor		Mvars at POI	Power Factor	
44	FLT_44_PLNSMEN4_FAIRMON4_138kV	-6.61	1	LEAD	-8.01	0.999	LEAD	-7.24	0.999	LEAD
45	FLT_45_G15063_MATHWSN7_345kV	15.27	0.998	LAG	9.41	0.999	LAG	10.28	0.999	LAG
46	FLT_46_MATHWSN7_CIMARON7_345kV	-6.06	1	LEAD	-7.59	0.999	LEAD	-7.02	0.999	LEAD
47	FLT_47_CLEVLND7_TNO7_345kV	6.91	1	LAG	-0.16	1	LEAD	-0.72	1	LEAD
48	FLT_48_CLEVLND7_CLEVLND4_345_138kV	-7.24	0.999	LEAD	-8.5	0.999	LEAD	-7.62	0.999	LEAD
49	FLT_49_UNIONRG6_SUMMIT6_230kV	-3.22	1	LEAD	-4.07	1	LEAD	-3.79	1	LEAD
50	FLT_50_UNIONRG6_MORRIS6_230kV	-7.23	0.999	LEAD	-8.02	0.999	LEAD	-7.42	0.999	LEAD
51	FLT_51_SUMMIT6_MCPHER6_230kV	-5.05	1	LEAD	-5.83	1	LEAD	-5.91	1	LEAD
52	FLT_52_SUMMIT6_SMOKYHL6_230kV	-4.84	1	LEAD	-6.49	1	LEAD	-6.23	1	LEAD
53	FLT_53_SUMMIT6_SUMMIT7_230_345kV	-9.24	0.999	LEAD	-8.28	0.999	LEAD	-7.88	0.999	LEAD
54	FLT_54_SUMMIT6_SUMMIT3_230_115kV	-6.37	1	LEAD	-7.65	0.999	LEAD	-6.99	0.999	LEAD
55	FLT_55_MORRIS6_MCDOWEL6_230kV	-5.42	1	LEAD	-7.19	0.999	LEAD	-6.53	1	LEAD
56	FLT_56_MORRIS6_SWISVAL6_230kV	-6.93	1	LEAD	-8.33	0.999	LEAD	-7.47	0.999	LEAD
57	FLT_57_MORRIS6_MORRIS3_230_115kV	-6.76	1	LEAD	-8	0.999	LEAD	-7.2	0.999	LEAD
58	FLT_58_MORRIS6_MORRIS7_230_345kV	-6.57	1	LEAD	-7.04	0.999	LEAD	-6.28	1	LEAD
59	FLT_59_EMPEC7_MORRIS7_345kV	-1.61	1	LEAD	-4.76	1	LEAD	-4.32	1	LEAD
60	FLT_60_EMPEC7_LANG7_345kV	-7.03	0.999	LEAD	-7.52	0.999	LEAD	-6.72	1	LEAD
61	FLT_61_EMPEC7_G14001TAP_345kV	4.92	1	LAG	3.82	1	LAG	3.42	1	LAG
62	FLT_62_EMPEC7_SWISVAL7_345kV	-2.3	1	LEAD	-6.05	1	LEAD	-4.56	1	LEAD
63	FLT_63_MORRIS7_JECN7_345kV	-3.88	1	LEAD	-7.29	0.999	LEAD	-6.72	1	LEAD
64	FLT_64_MORRIS7_MORRIS6_345_230kV	-6.57	1	LEAD	-7.04	0.999	LEAD	-6.28	1	LEAD
65	FLT_65_SWISVAL7_WGRDNR7_345kV	-9.61	0.999	LEAD	-10.97	0.999	LEAD	-8.91	0.999	LEAD
66	FLT_66_SWISVAL7_SWISVAL6_345_230kV	-7.14	0.999	LEAD	-7.93	0.999	LEAD	-7.19	0.999	LEAD
67	FLT_67_LANG7_LANG3_345_115kV	-6.45	1	LEAD	-7.53	0.999	LEAD	-6.73	1	LEAD
68	FLT_68_G14001TAP_WICHITA7_345kV	3.37	1	LAG	2.37	1	LAG	2.19	1	LAG
69	FLT_69_SC10BEL4_FARBER4_138kV	-6.71	1	LEAD	-6.87	1	LEAD	-6.14	1	LEAD
70	FLT_70_SC10BEL4_SUMNER4_138kV	-8	0.999	LEAD	-8.1	0.999	LEAD	-7.2	0.999	LEAD
71	FLT_71_FARBER4_ELPASO4_138kV	-7.95	0.999	LEAD	-7.84	0.999	LEAD	-6.86	1	LEAD
72	FLT_72_SUMNER4_OXFORD4_138kV	-6.95	1	LEAD	-8.01	0.999	LEAD	-7.56	0.999	LEAD
73	FLT_73_SUMNER4_TIMBJCT4_138kV	-5.23	1	LEAD	-7.56	0.999	LEAD	-6.57	1	LEAD
74	FLT_74_UNIONRG6_UNIONRG3_230_115kV	-7.38	0.999	LEAD	-8.77	0.999	LEAD	-7.81	0.999	LEAD

Appendix E – Reduced Wind Generation Analysis Results

Below figures are from the 2016WP model with identified upgrades in-service. The other two cases (2017SP and 2025SP) were almost identical since the Interconnection Request facilities design is the same in all cases.

Figure E-1*:* GEN-2015-034 with generators turned off

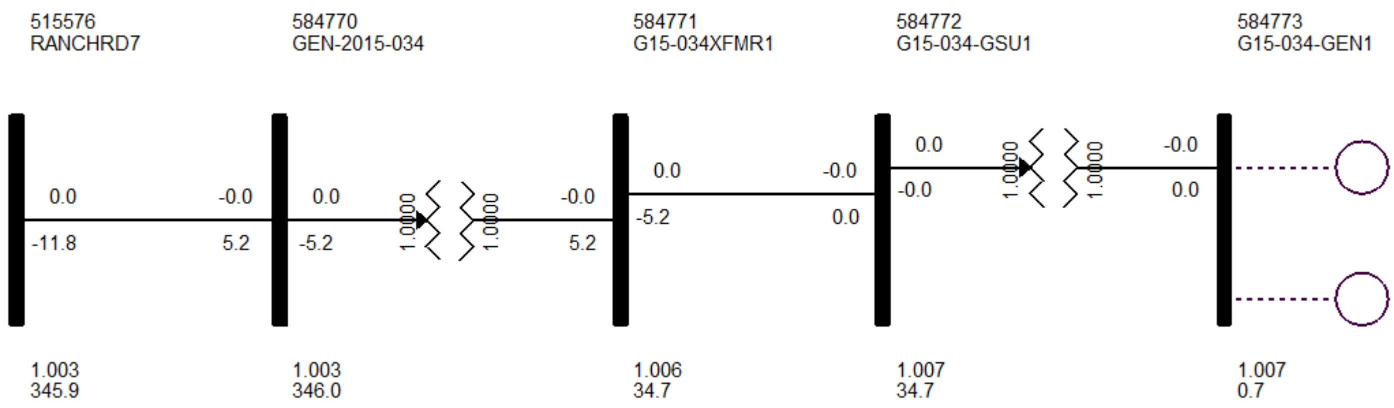


Figure E-2*:* GEN-2015-034 with generators turned off and shunt reactors added to the customer 34.5kV substation

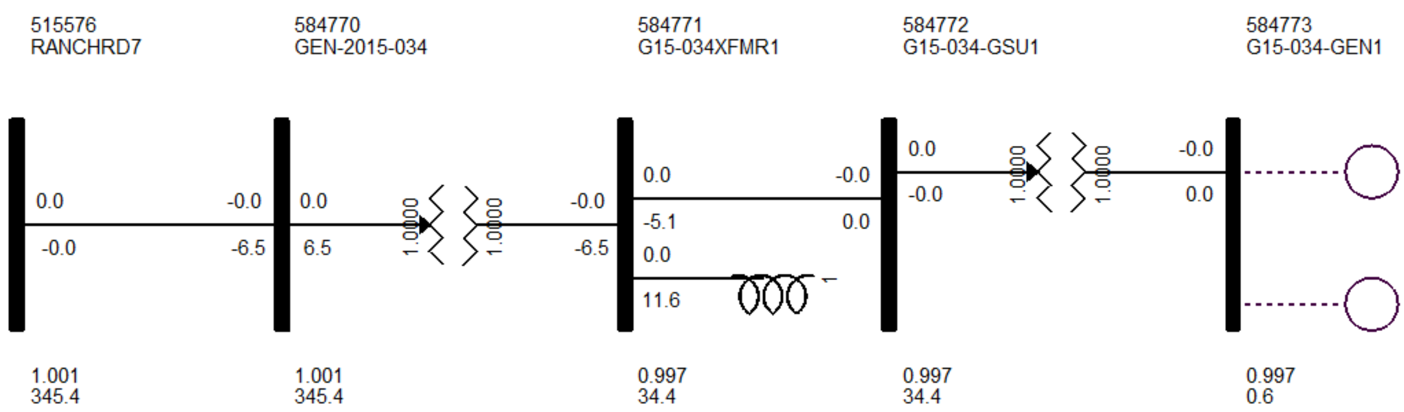


Figure E-3: GEN-2015-047 with generators turned off

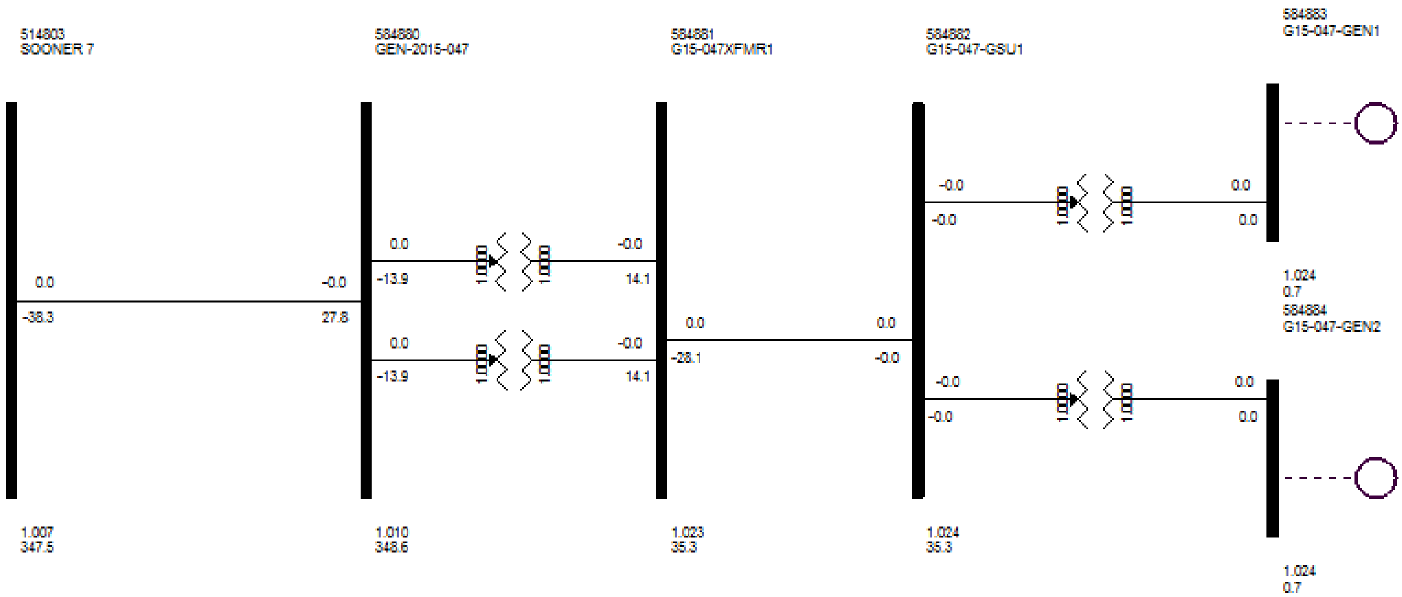


Figure E-4: GEN-2015-047 with generators turned off and shunt reactors added to the customer 34.5kV substation

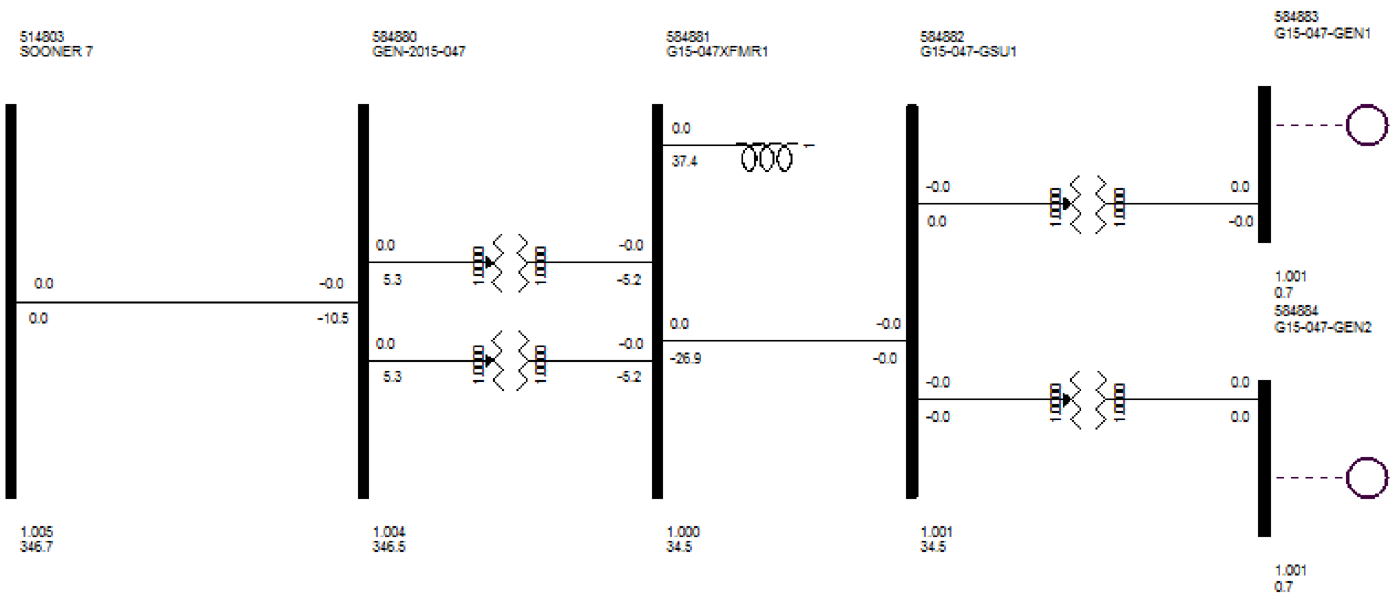


Figure E-5: GEN-2015-052 with generators turned off

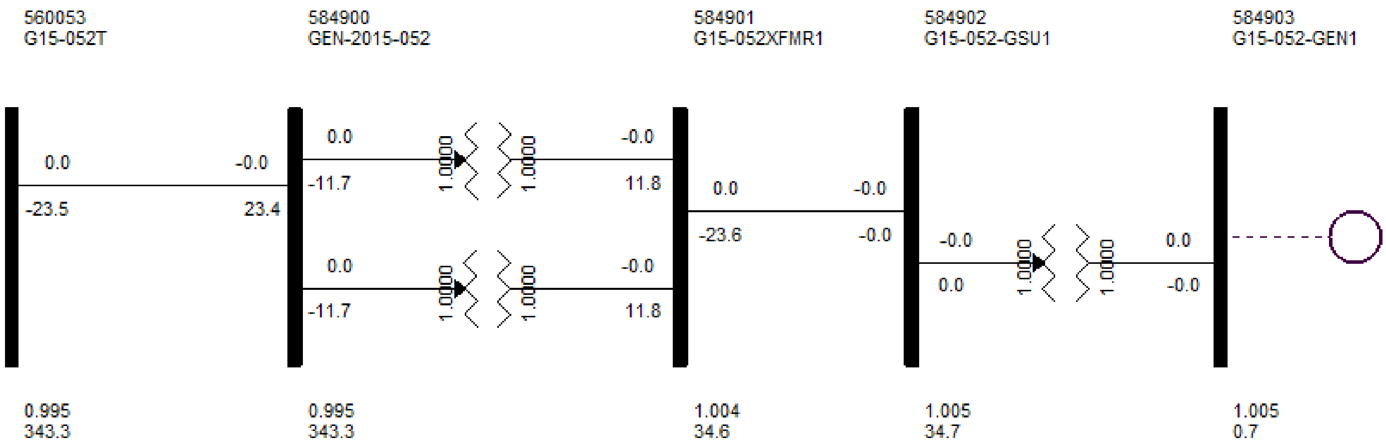


Figure E-6: GEN-2015-052 with generators turned off and shunt reactors added to the customer 34.5kV substation

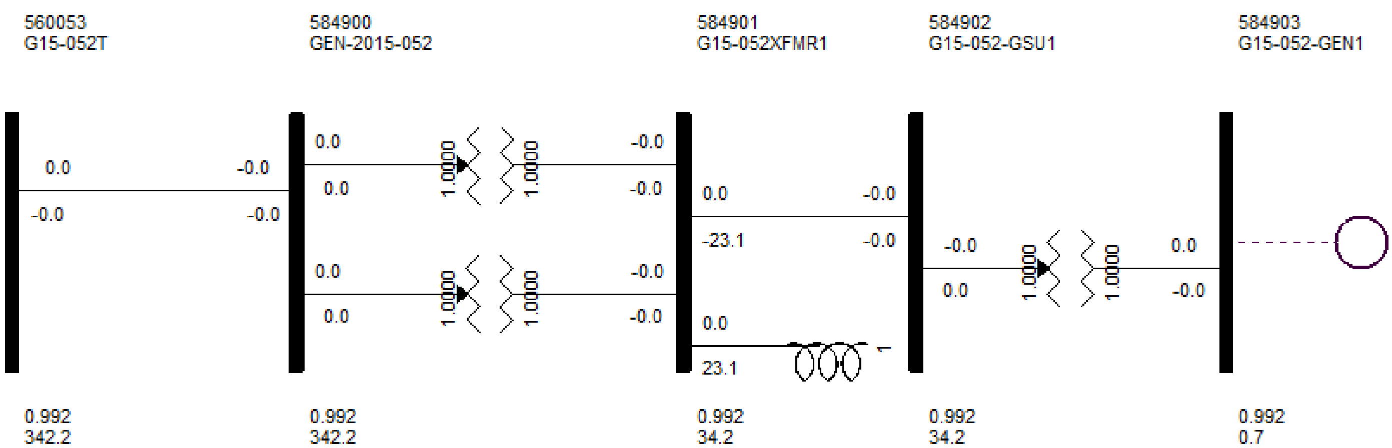


Figure E-7: GEN-2015-062 with generators turned off

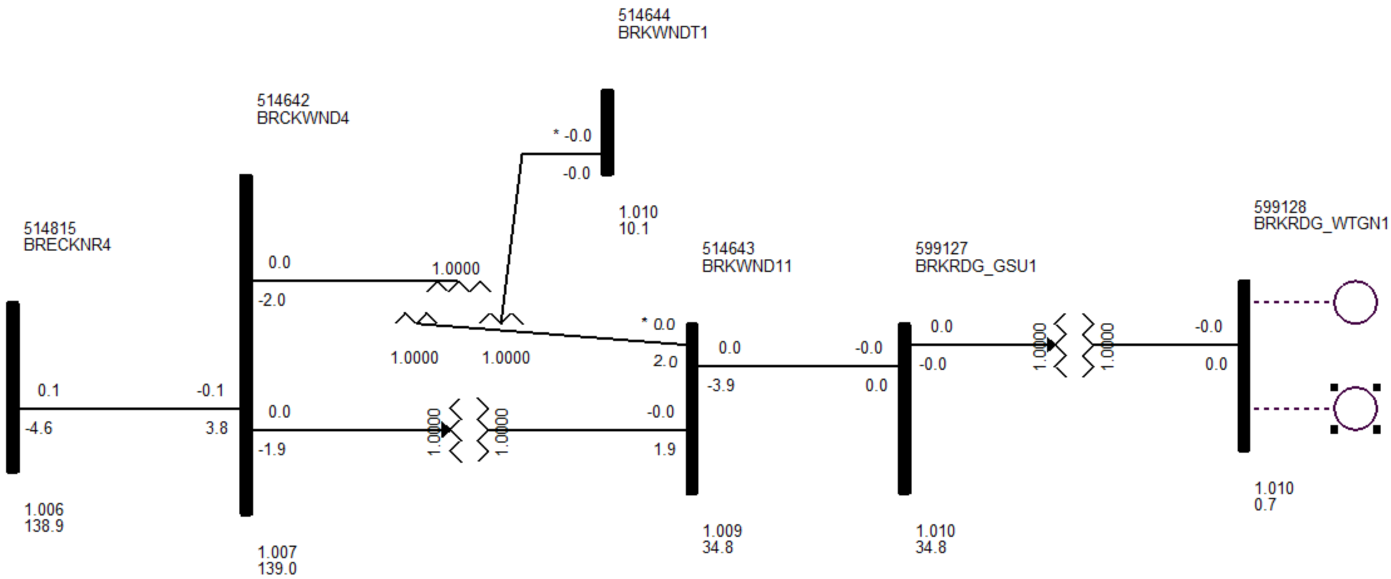


Figure E-8: GEN-2015-062 with generators turned off and shunt reactors added to the customer 34.5kV substation

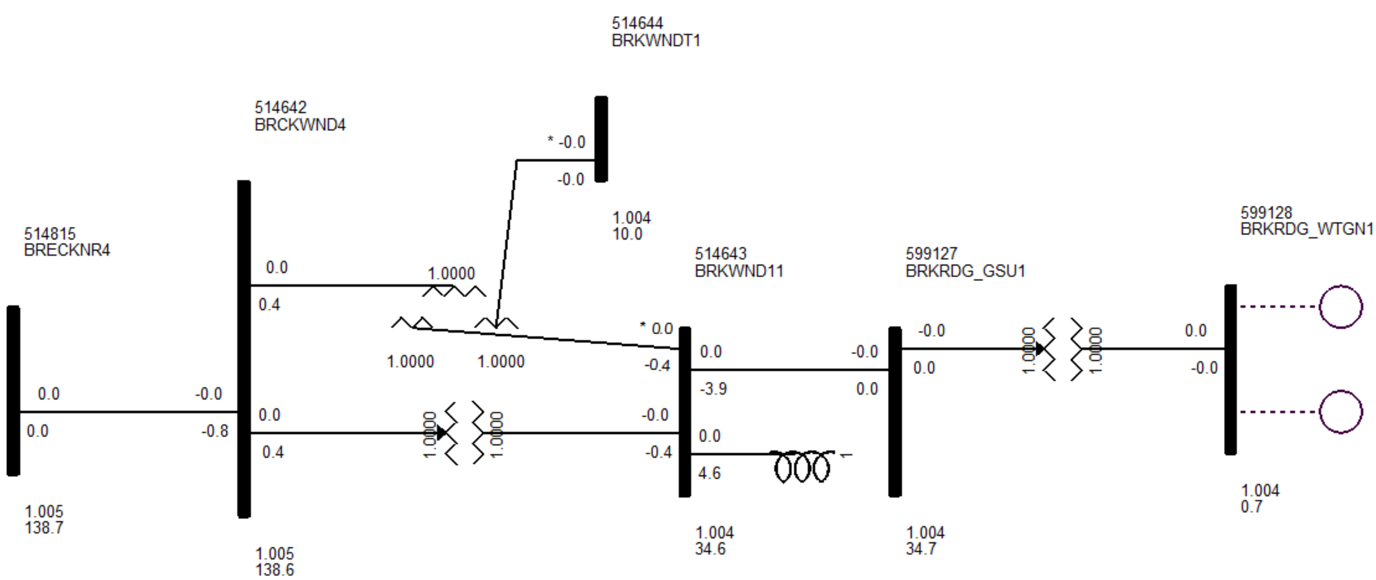


Figure E-9: GEN-2015-063 with generators turned off

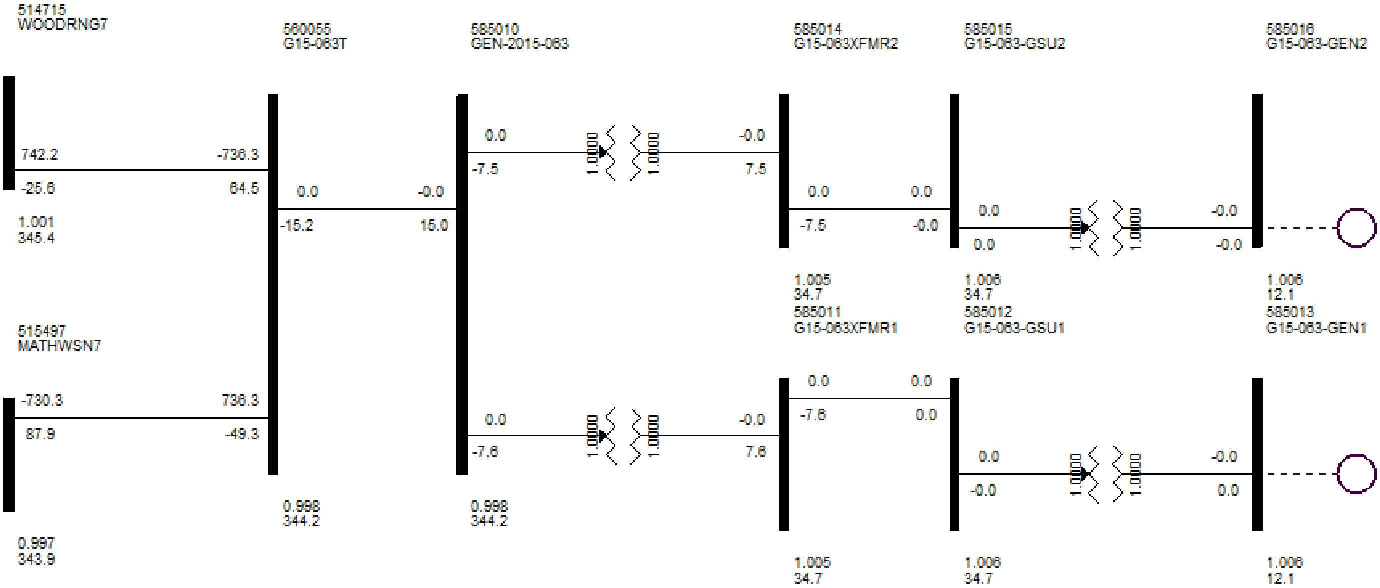


Figure E-10: GEN-2015-063 with generators turned off and shunt reactors added to the customer 34.5kV substation

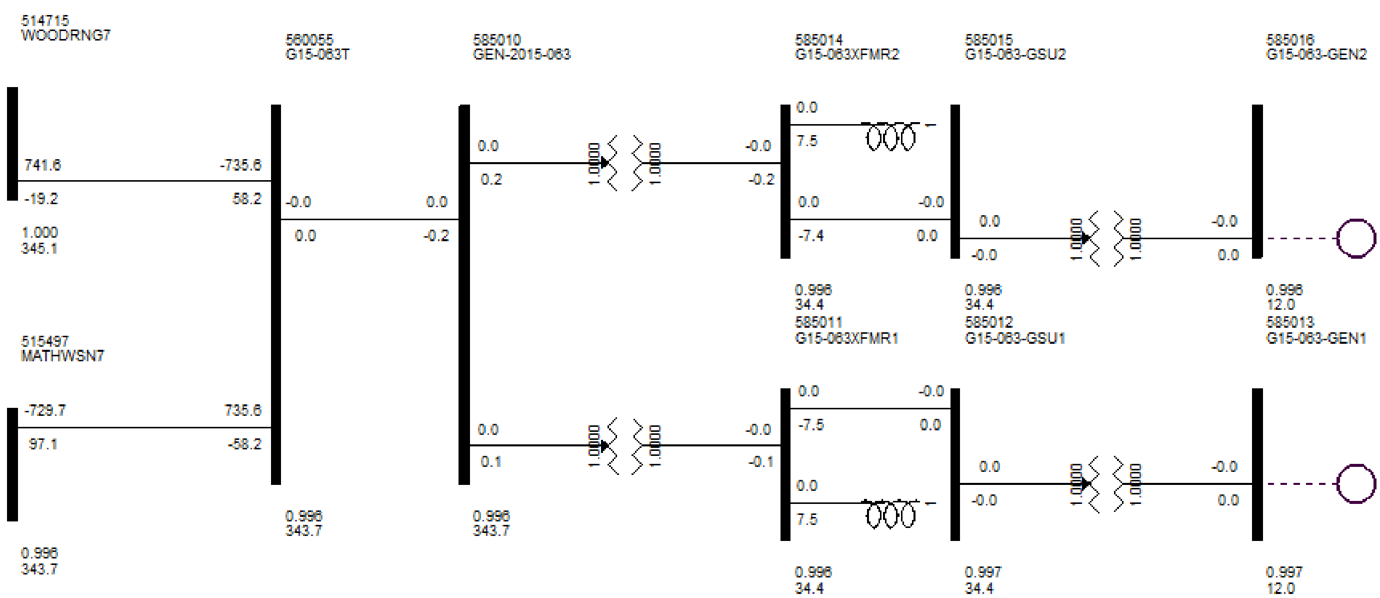


Figure E-11: GEN-2015-066 with generators turned off

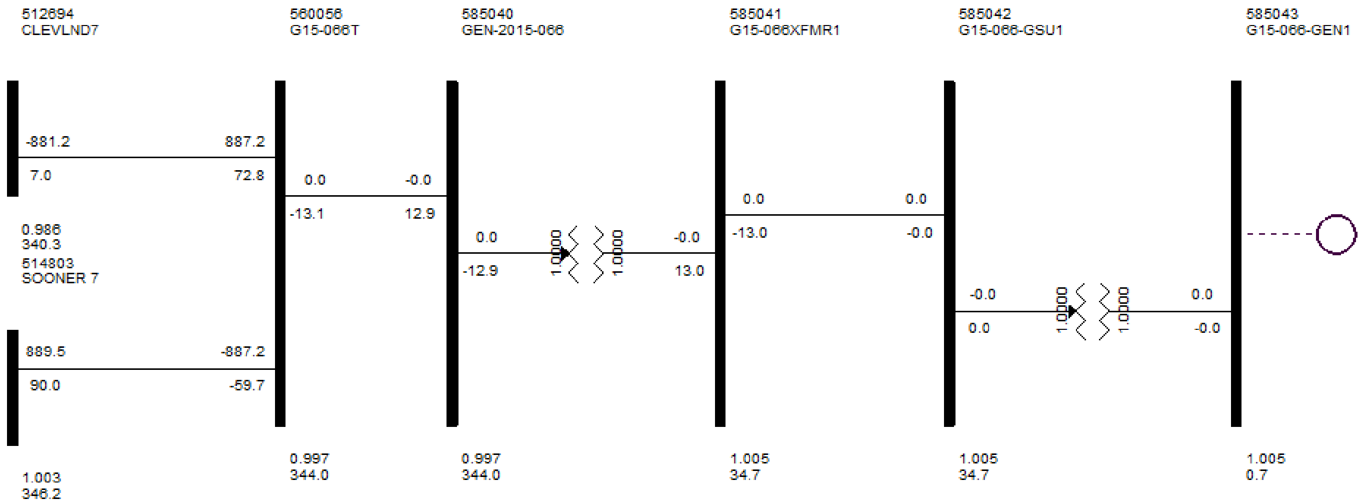


Figure E-12: GEN-2015-066 with generators turned off and shunt reactors added to the customer 34.5kV substation

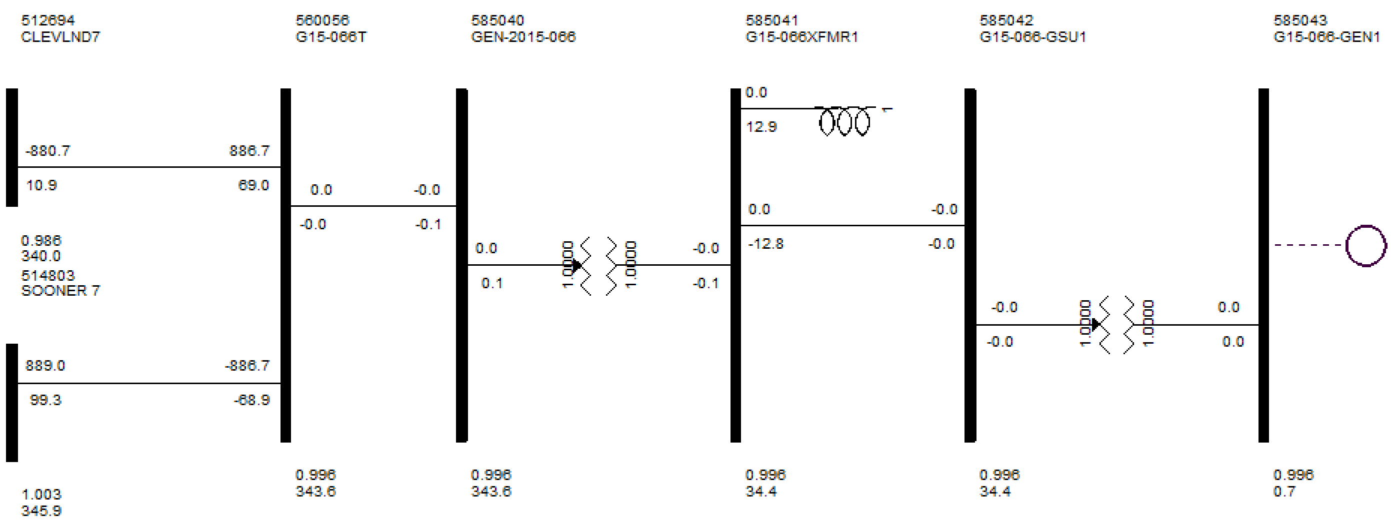


Figure E-13: GEN-2015-069 with generators turned off

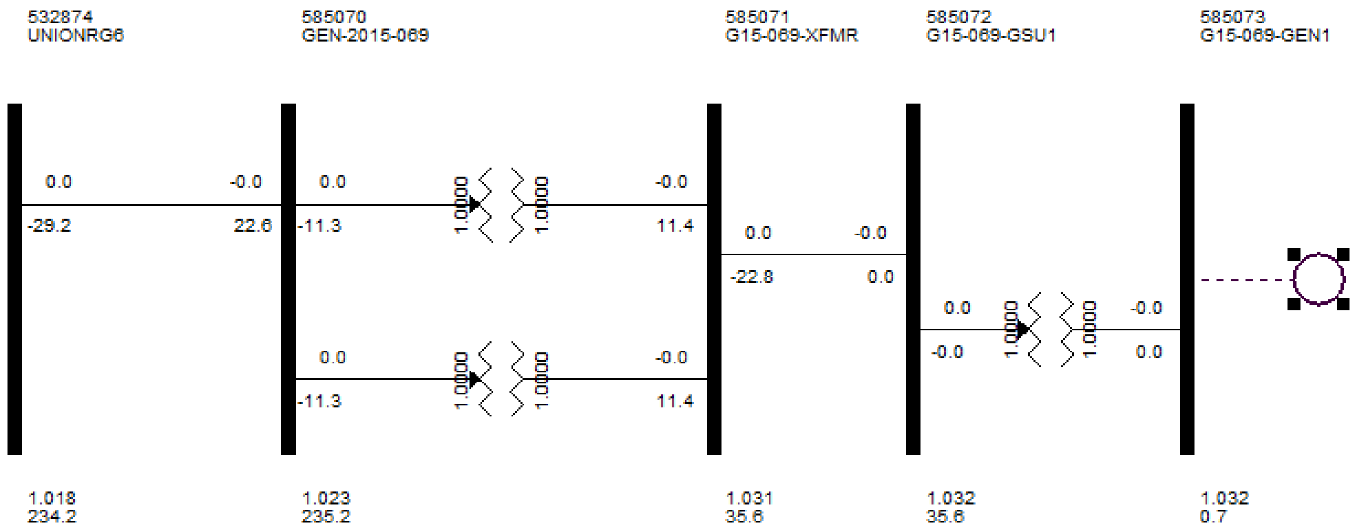


Figure E-14: GEN-2015-069 with generators turned off and shunt reactors added to the customer 34.5kV substation

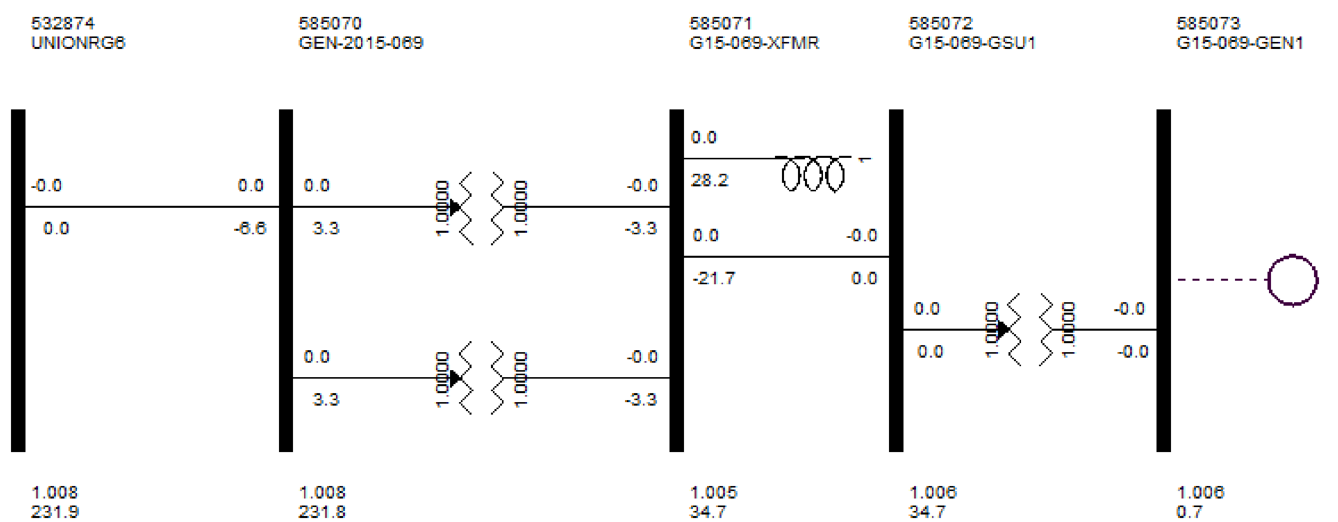


Figure E-15*:* GEN-2015-073 with generators turned off

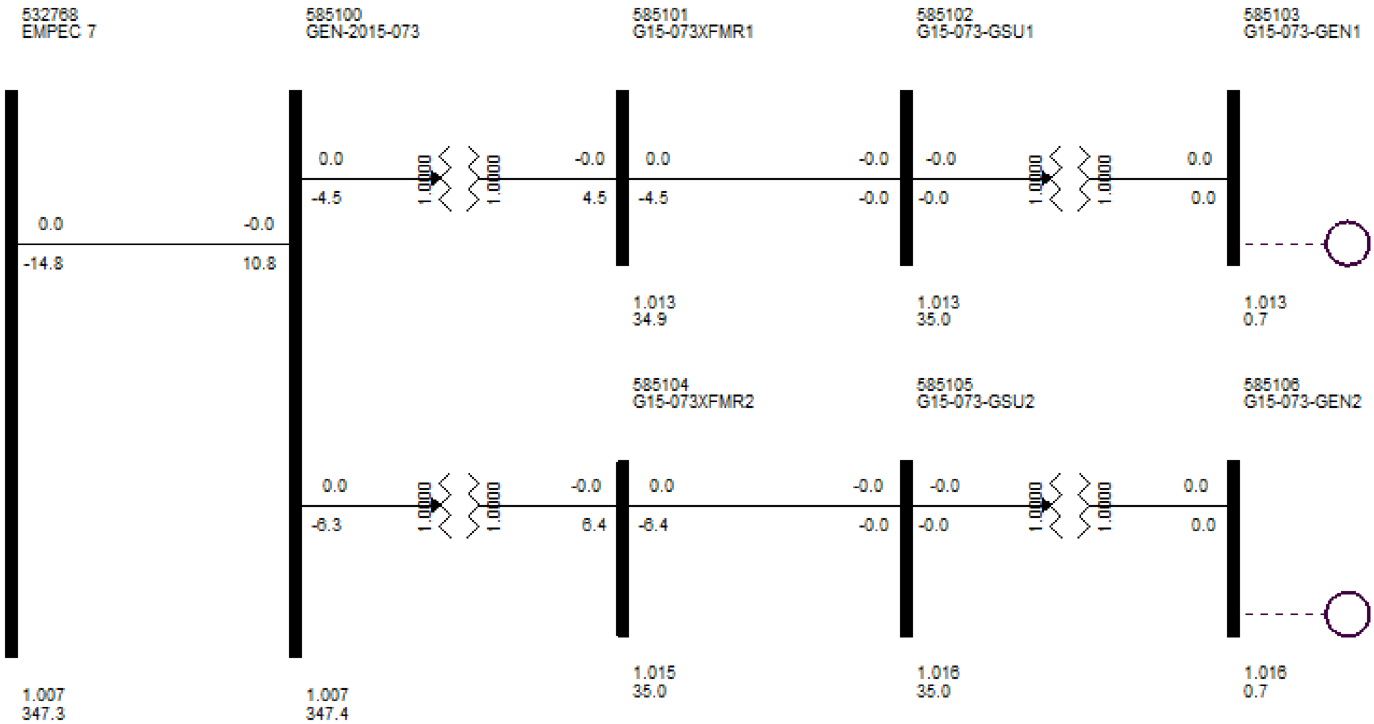


Figure E-16*:* GEN-2015-073 with generators turned off and shunt reactors added to the customer 34.5kV substation

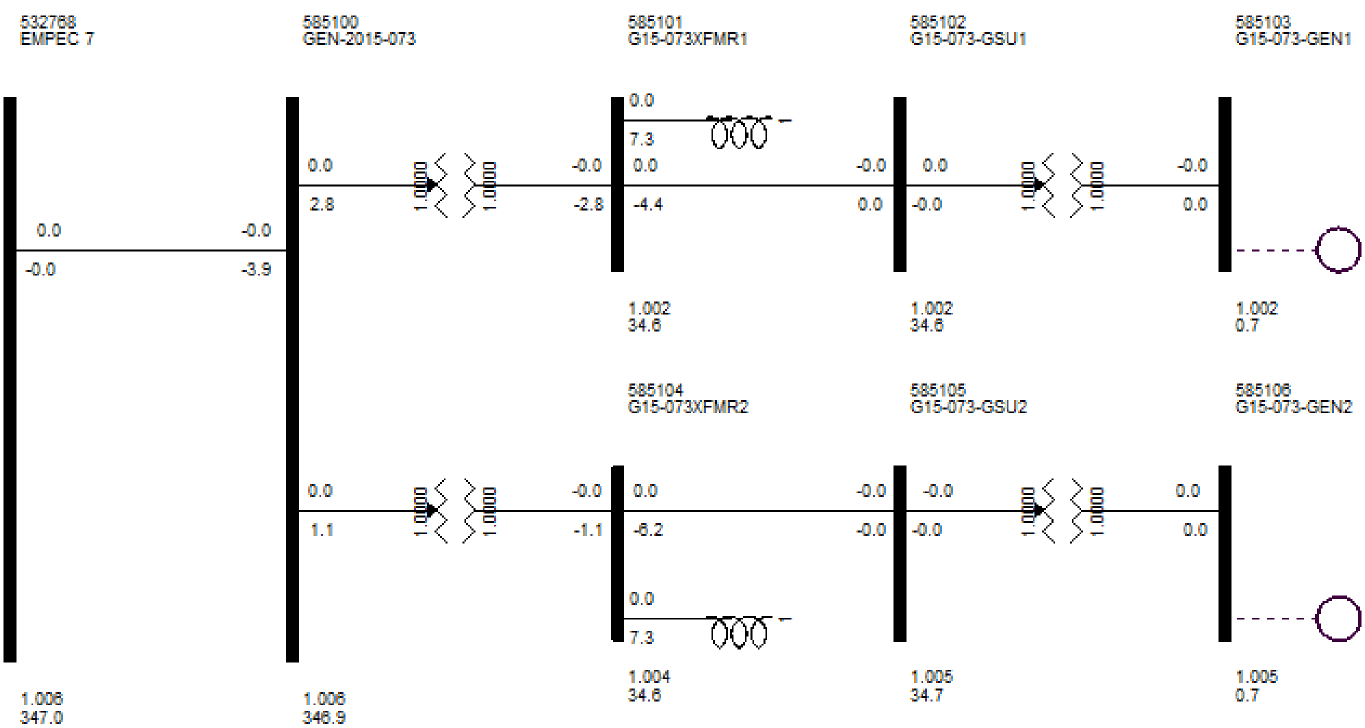


Figure E-17: GEN-2015-083 with generators turned off

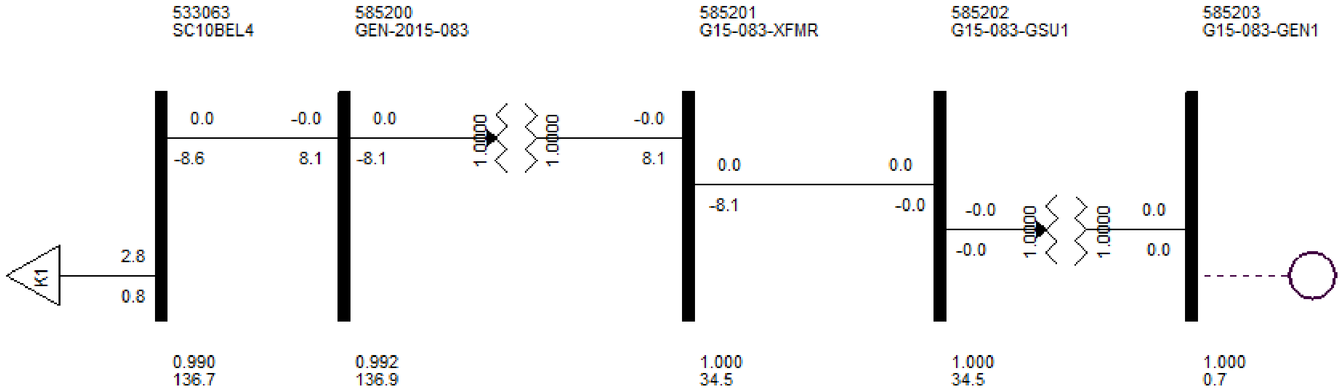


Figure E-18: GEN-2015-083 with generators turned off and shunt reactors added to the customer 34.5kV substation

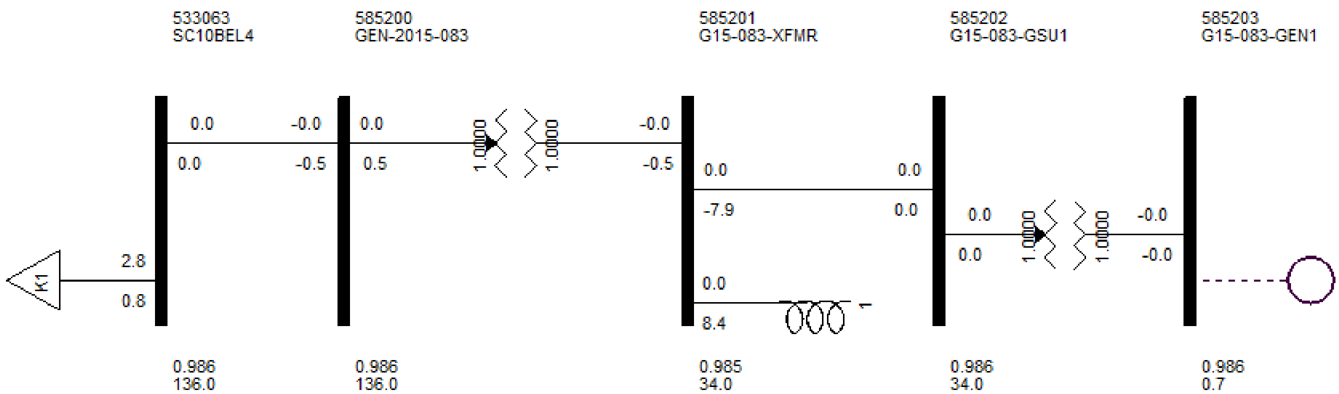


Figure E-19: GEN-2015-090 with generators turned off

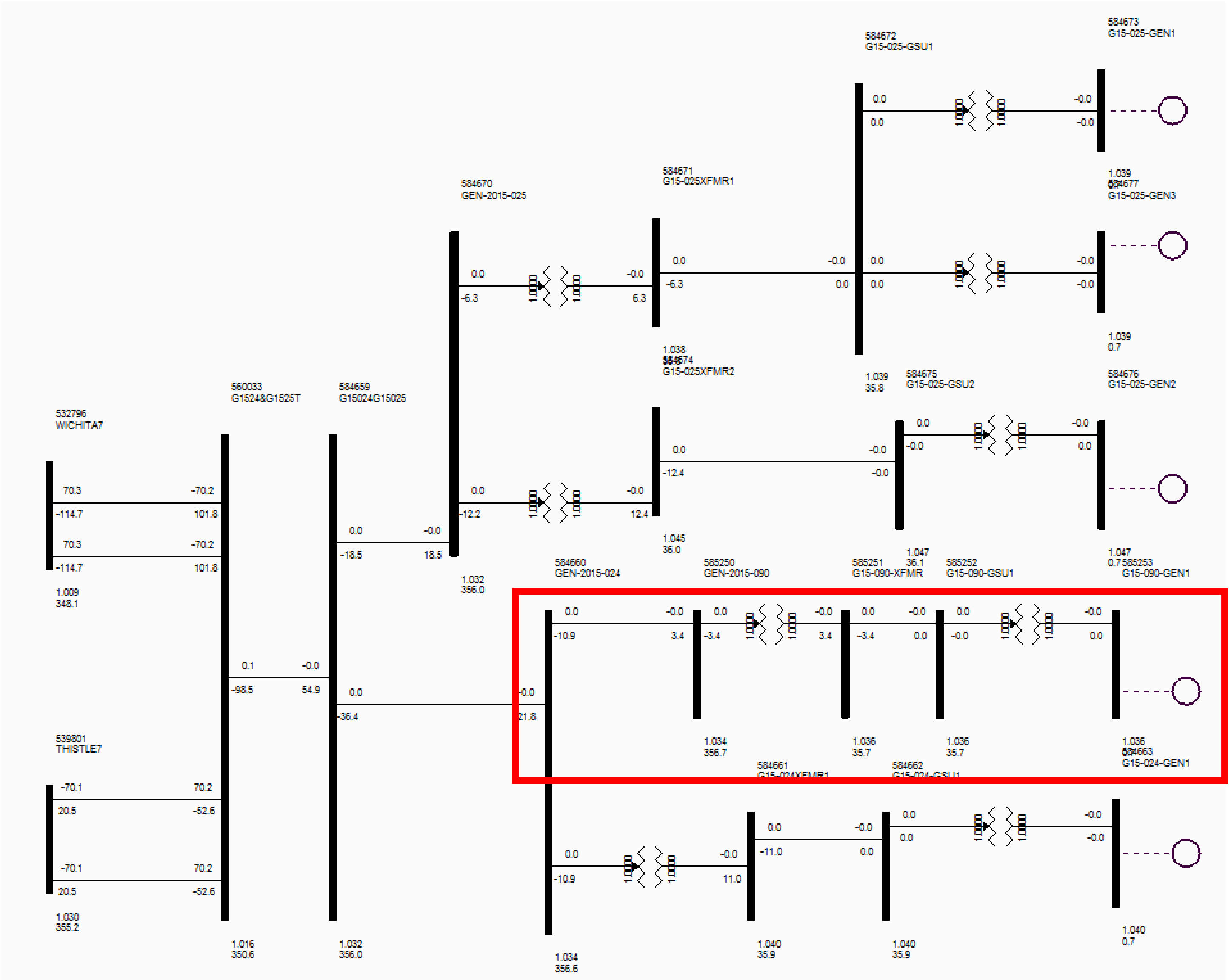
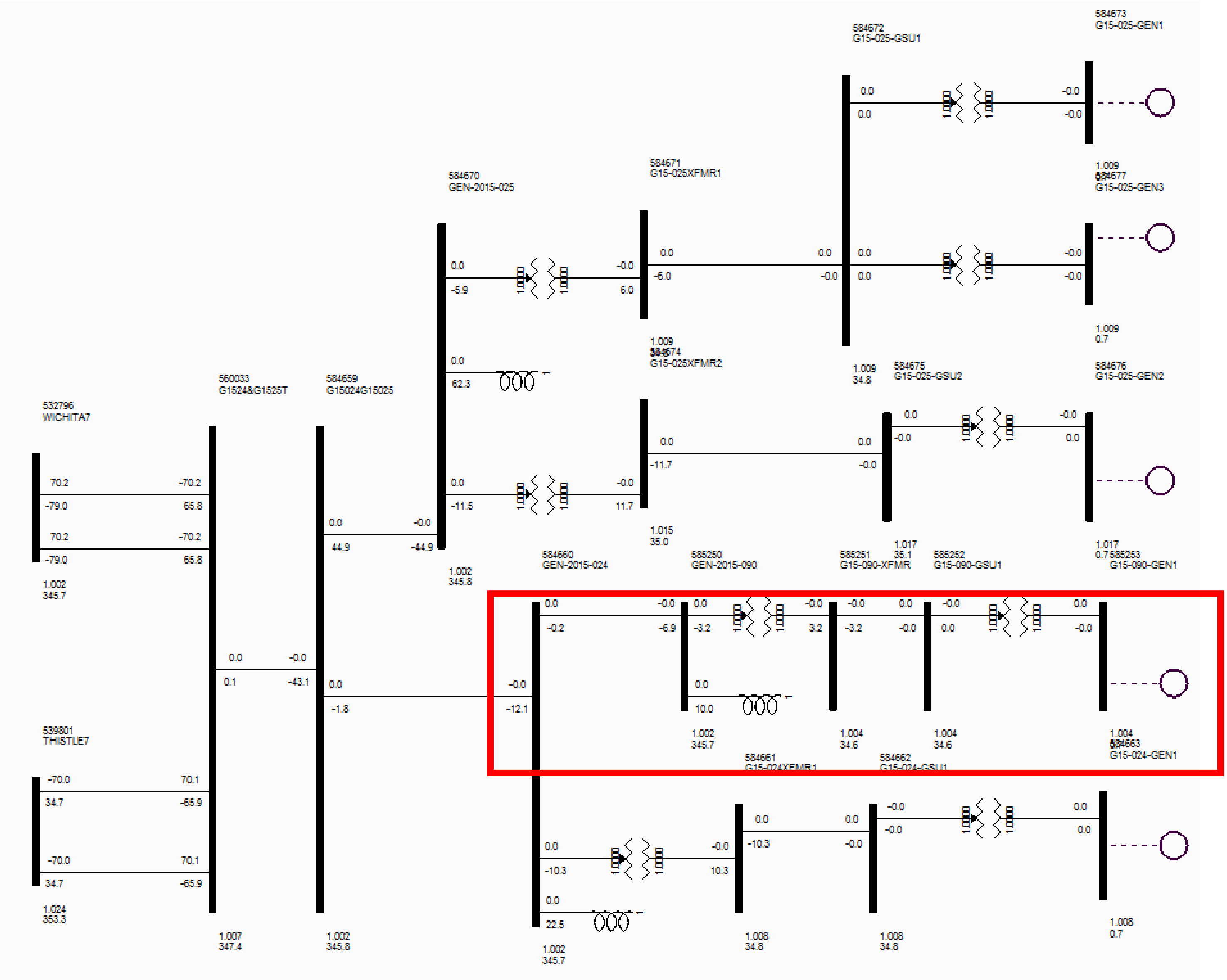


Figure E-20*:* GEN-2015-090 with generators turned off and shunt reactors added to the customer 34.5kV substation



Appendix F – Short Circuit Analysis Results

GEN-2015-034 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:00
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
515576 [RANCHRD7    345.00] AMP    13873.1   -86.68
514803 [SOONER 7    345.00] AMP    24626.1   -86.49
515621 [OPENSKY7    345.00] AMP    12828.8   -86.64
529200 [OMCDLEC7    345.00] AMP    13847.3   -86.67
584450 [G1501-G1631 345.00] AMP    11137.1   -85.62
584770 [GEN-2015-034345.00] AMP    11812.8   -86.26
514802 [SOONER 4    138.00] AMP    31411.9   -86.77
514825 [KAYWIND7    345.00] AMP    12795.3   -86.64
514881 [SPRNGCK7    345.00] AMP    21411.7   -85.53
560053 [G15-052T    345.00] AMP    13151.1   -86.46
560056 [G15-066T    345.00] AMP    17997.4   -86.55
560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
584690 [GEN-2015-030345.00] AMP    18751.0   -85.92
584880 [GEN-2015-047345.00] AMP    11012.1   -83.66
512694 [CLEVLND7    345.00] AMP    14858.5   -86.35
514704 [MILLERT4    138.00] AMP    20178.4   -85.57
514707 [PERRY  4    138.00] AMP    10947.5   -83.28
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
514798 [SNRPMPT4    138.00] AMP    20201.9   -85.53
514880 [NORTWST7    345.00] AMP    29354.6   -86.04
515447 [MORISNT4    138.00] AMP    13669.6   -82.93
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
584900 [GEN-2015-052345.00] AMP    13100.6   -86.43
585040 [GEN-2015-066345.00] AMP    17832.1   -86.52
509852 [T.NO.--7    345.00] AMP    23431.8   -86.30
512729 [CLEVLND 4   138.00] AMP    16790.8   -85.48
514706 [COWCRK 4    138.00] AMP    11245.6   -82.98
514714 [WOODRNG4    138.00] AMP    18630.9   -83.29
514737 [OTOE   4    138.00] AMP    16121.8   -83.27
514743 [OSAGE  4    138.00] AMP    15713.3   -81.70
514799 [SNRPMP 4    138.00] AMP    11194.4   -80.55
514879 [NORTWST4    138.00] AMP    42442.1   -85.92
514901 [CIMARON7    345.00] AMP    29712.0   -85.76
514908 [ARCADIA7    345.00] AMP    24883.9   -86.46
515006 [MORRISN4    138.00] AMP    13639.4   -82.92
515011 [STILWTR4    138.00] AMP    13319.6   -80.16
515412 [DMNCRKT4    138.00] AMP    13499.8   -84.32
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515497 [MATHWSN7    345.00] AMP    27519.2   -85.77
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
533062 [ROSEHIL4    138.00] AMP    31012.2   -86.17
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560055 [G15-063T    345.00] AMP    16757.8   -84.89
300138 [4CLEVLND    138.00] AMP    16793.2   -85.46
509755 [WEKIWA-7    345.00] AMP    18607.3   -86.20
509895 [T.NO.2-4    138.00] AMP    34237.3   -84.98
510376 [WEBBTAP4    138.00] AMP     8154.9   -79.09
510406 [N.E.S.-7    345.00] AMP    18726.5   -86.41
512865 [GREC TAP5   345.00] AMP    25569.5   -87.31
514705 [COWCRK 2    69.000] AMP     4044.1   -86.74
514708 [OTTER  4    138.00] AMP     9520.8   -82.41
514709 [FRMNTAP4    138.00] AMP    17455.5   -82.87
514711 [WAUKOTP4    138.00] AMP    14930.9   -81.71
514713 [WRVALLY4    138.00] AMP     8658.7   -82.14
514733 [MARSHL 4    138.00] AMP     7784.1   -80.53
514742 [OSGE   2    69.000] AMP    14683.5   -84.40
514758 [STDBEAR4    138.00] AMP    13287.0   -81.64
514761 [WHEAGLE4    138.00] AMP    14989.8   -81.76
514770 [MARLNDT4    138.00] AMP    10590.1   -76.91
514801 [MINCO  7    345.00] AMP    16166.3   -85.15
514828 [KETCHTP4    138.00] AMP    26013.7   -84.55
514854 [BRADEN 4    138.00] AMP    30755.0   -85.14
514873 [LNEOAK 4    138.00] AMP    26423.7   -84.56
514898 [CIMARON4    138.00] AMP    42021.4   -84.99
514907 [ARCADIA4    138.00] AMP    40842.6   -85.63
514909 [REDBUD 7    345.00] AMP    23853.8   -86.78
514934 [DRAPER 7    345.00] AMP    20389.5   -85.14
515045 [SEMINOL7    345.00] AMP    25941.6   -86.18
515181 [UNVRSTY4    138.00] AMP    13444.6   -79.90
515400 [DMANCRK4    138.00] AMP     7972.7   -80.19
515407 [TATONGA7    345.00] AMP    10482.3   -86.78
515471 [NW164TH4    138.00] AMP    34845.0   -85.66
515477 [CHSHLMV7    345.00] AMP    12066.1   -84.69
515512 [SPVALLY4    138.00] AMP     8677.6   -77.82
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
515610 [FSHRTAP7    345.00] AMP    15917.8   -85.09
532780 [CANEYRV7    345.00] AMP     9890.8   -85.50
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
532799 [WAVERLY7    345.00] AMP    14714.1   -86.51
532801 [ELKRVR17    345.00] AMP     9239.4   -85.46
532986 [BENTON 4    138.00] AMP    27920.3   -85.85
532991 [WEAVER 4    138.00] AMP    21770.4   -83.96
533039 [ELPASO 4    138.00] AMP    24353.8   -84.19
533068 [STEARMN4    138.00] AMP    19364.9   -84.21
533653 [WOLFCRK2    69.000] AMP     5807.4   -87.18
585010 [GEN-2015-063345.00] AMP    16485.7   -84.83
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:52
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
515576 [RANCHRD7    345.00] AMP    13911.7   -86.68
514803 [SOONER 7    345.00] AMP    24819.4   -86.49
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
529200 [OMCDLEC7    345.00] AMP    13885.7   -86.67
584450 [G1501-G1631 345.00] AMP    11161.1   -85.62
584770 [GEN-2015-034345.00] AMP    11840.1   -86.25
514802 [SOONER 4    138.00] AMP    31906.3   -86.80
514825 [KAYWIND7    345.00] AMP    12832.5   -86.64
514881 [SPRNGCK7    345.00] AMP    21906.6   -85.52
560053 [G15-052T    345.00] AMP    13222.6   -86.46
560056 [G15-066T    345.00] AMP    18088.8   -86.54
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
584690 [GEN-2015-030345.00] AMP    18861.8   -85.91
584880 [GEN-2015-047345.00] AMP    11045.5   -83.64
512694 [CLEVLND7    345.00] AMP    14920.4   -86.34
514704 [MILLERT4    138.00] AMP    20472.7   -85.60
514707 [PERRY  4    138.00] AMP    11017.4   -83.26
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
514798 [SNRPMPT4    138.00] AMP    20526.7   -85.58
514880 [NORTWST7    345.00] AMP    30523.4   -86.08
515447 [MORISNT4    138.00] AMP    13886.8   -82.89
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
584900 [GEN-2015-052345.00] AMP    13171.6   -86.44
585040 [GEN-2015-066345.00] AMP    17921.7   -86.52
509852 [T.NO.--7    345.00] AMP    23628.4   -86.30
512729 [CLEVLND 4   138.00] AMP    16838.3   -85.48
514706 [COWCRK 4    138.00] AMP    11321.7   -82.96
514714 [WOODRNG4    138.00] AMP    18755.9   -83.28
514737 [OTOE   4    138.00] AMP    16309.3   -83.27
514743 [OSAGE  4    138.00] AMP    16704.4   -81.98
514799 [SNRPMP 4    138.00] AMP    11293.5   -80.54
514879 [NORTWST4    138.00] AMP    42925.0   -85.97
514901 [CIMARON7    345.00] AMP    31112.9   -85.94
514908 [ARCADIA7    345.00] AMP    26069.9   -86.55
515006 [MORRISN4    138.00] AMP    13855.3   -82.89
515011 [STILWTR4    138.00] AMP    13902.4   -80.02
515412 [DMNCRKT4    138.00] AMP    13761.8   -84.38
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515497 [MATHWSN7    345.00] AMP    29657.1   -86.07
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
560055 [G15-063T    345.00] AMP    17188.7   -84.94
300138 [4CLEVLND    138.00] AMP    16840.8   -85.46
509755 [WEKIWA-7    345.00] AMP    18794.5   -86.22
509895 [T.NO.2-4    138.00] AMP    34421.2   -84.97
510376 [WEBBTAP4    138.00] AMP     8253.5   -79.08
510406 [N.E.S.-7    345.00] AMP    18851.5   -86.42
512865 [GREC TAP5   345.00] AMP    25892.4   -87.33
514705 [COWCRK 2    69.000] AMP     4049.0   -86.74
514708 [OTTER  4    138.00] AMP     9550.1   -82.39
514709 [FRMNTAP4    138.00] AMP    17566.5   -82.86
514711 [WAUKOTP4    138.00] AMP    15017.2   -81.71
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514713 [WRVALLY4    138.00] AMP     8694.6   -82.12
514733 [MARSHL 4    138.00] AMP     7801.1   -80.52
514742 [OSGE   2    69.000] AMP    17574.7   -84.60
514758 [STDBEAR4    138.00] AMP    13945.6   -81.82
514761 [WHEAGLE4    138.00] AMP    15727.2   -81.86
514770 [MARLNDT4    138.00] AMP    10967.6   -76.88
514801 [MINCO  7    345.00] AMP    16528.1   -85.20
514828 [KETCHTP4    138.00] AMP    26063.9   -84.56
514854 [BRADEN 4    138.00] AMP    30928.2   -85.16
514873 [LNEOAK 4    138.00] AMP    26553.9   -84.59
514898 [CIMARON4    138.00] AMP    42376.5   -85.06
514907 [ARCADIA4    138.00] AMP    41271.5   -85.71
514909 [REDBUD 7    345.00] AMP    25389.3   -86.83
514934 [DRAPER 7    345.00] AMP    20544.1   -85.12
515045 [SEMINOL7    345.00] AMP    26110.6   -86.15
515181 [UNVRSTY4    138.00] AMP    13740.1   -79.82
515400 [DMANCRK4    138.00] AMP     8063.5   -80.18
515407 [TATONGA7    345.00] AMP    15928.8   -86.55
515471 [NW164TH4    138.00] AMP    35153.6   -85.69
515477 [CHSHLMV7    345.00] AMP    12423.3   -84.73
515512 [SPVALLY4    138.00] AMP     8870.7   -77.69
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
515610 [FSHRTAP7    345.00] AMP    16266.6   -85.14
515644 [STLWTR2     69.000] AMP    16292.2   -78.23
532780 [CANEYRV7    345.00] AMP     9934.8   -85.50
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
532799 [WAVERLY7    345.00] AMP    14765.6   -86.51
532801 [ELKRVR17    345.00] AMP     9282.6   -85.46
532986 [BENTON 4    138.00] AMP    28467.8   -85.82
532991 [WEAVER 4    138.00] AMP    22302.1   -83.88
533039 [ELPASO 4    138.00] AMP    25627.9   -84.16
533068 [STEARMN4    138.00] AMP    19919.5   -84.15
533653 [WOLFCRK2    69.000] AMP     6015.6   -87.23
585010 [GEN-2015-063345.00] AMP    16901.5   -84.88
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GEN-2015-047 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:00
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X--------- BUS ----------X           /I+/    AN(I+)
514803 [SOONER 7    345.00] AMP    24626.1   -86.49
514802 [SOONER 4    138.00] AMP    31411.9   -86.77
514881 [SPRNGCK7    345.00] AMP    21411.7   -85.53
515576 [RANCHRD7    345.00] AMP    13873.1   -86.68
560056 [G15-066T    345.00] AMP    17997.4   -86.55
560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
584690 [GEN-2015-030345.00] AMP    18751.0   -85.92
584880 [GEN-2015-047345.00] AMP    11012.1   -83.66
512694 [CLEVLND7    345.00] AMP    14858.5   -86.35
514704 [MILLERT4    138.00] AMP    20178.4   -85.57
514707 [PERRY  4    138.00] AMP    10947.5   -83.28
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
514798 [SNRPMPT4    138.00] AMP    20201.9   -85.53
514880 [NORTWST7    345.00] AMP    29354.6   -86.04
515447 [MORISNT4    138.00] AMP    13669.6   -82.93
515621 [OPENSKY7    345.00] AMP    12828.8   -86.64
529200 [OMCDLEC7    345.00] AMP    13847.3   -86.67
584450 [G1501-G1631 345.00] AMP    11137.1   -85.62
584770 [GEN-2015-034345.00] AMP    11812.8   -86.26
585040 [GEN-2015-066345.00] AMP    17832.1   -86.52
509852 [T.NO.--7    345.00] AMP    23431.8   -86.30
512729 [CLEVLND 4   138.00] AMP    16790.8   -85.48
514706 [COWCRK 4    138.00] AMP    11245.6   -82.98
514714 [WOODRNG4    138.00] AMP    18630.9   -83.29
514737 [OTOE   4    138.00] AMP    16121.8   -83.27
514743 [OSAGE  4    138.00] AMP    15713.3   -81.70
514799 [SNRPMP 4    138.00] AMP    11194.4   -80.55
514825 [KAYWIND7    345.00] AMP    12795.3   -86.64
514879 [NORTWST4    138.00] AMP    42442.1   -85.92
514901 [CIMARON7    345.00] AMP    29712.0   -85.76
514908 [ARCADIA7    345.00] AMP    24883.9   -86.46
515006 [MORRISN4    138.00] AMP    13639.4   -82.92
515011 [STILWTR4    138.00] AMP    13319.6   -80.16
515412 [DMNCRKT4    138.00] AMP    13499.8   -84.32
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515497 [MATHWSN7    345.00] AMP    27519.2   -85.77
560053 [G15-052T    345.00] AMP    13151.1   -86.46
560055 [G15-063T    345.00] AMP    16757.8   -84.89
300138 [4CLEVLND    138.00] AMP    16793.2   -85.46
509755 [WEKIWA-7    345.00] AMP    18607.3   -86.20
509895 [T.NO.2-4    138.00] AMP    34237.3   -84.98
510376 [WEBBTAP4    138.00] AMP     8154.9   -79.09
510406 [N.E.S.-7    345.00] AMP    18726.5   -86.41
512865 [GREC TAP5   345.00] AMP    25569.5   -87.31
514705 [COWCRK 2    69.000] AMP     4044.1   -86.74
514708 [OTTER  4    138.00] AMP     9520.8   -82.41
514709 [FRMNTAP4    138.00] AMP    17455.5   -82.87
514711 [WAUKOTP4    138.00] AMP    14930.9   -81.71
514713 [WRVALLY4    138.00] AMP     8658.7   -82.14
514733 [MARSHL 4    138.00] AMP     7784.1   -80.53
514742 [OSGE   2    69.000] AMP    14683.5   -84.40
514758 [STDBEAR4    138.00] AMP    13287.0   -81.64
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514761 [WHEAGLE4    138.00] AMP    14989.8   -81.76
514770 [MARLNDT4    138.00] AMP    10590.1   -76.91
514801 [MINCO  7    345.00] AMP    16166.3   -85.15
514828 [KETCHTP4    138.00] AMP    26013.7   -84.55
514854 [BRADEN 4    138.00] AMP    30755.0   -85.14
514873 [LNEOAK 4    138.00] AMP    26423.7   -84.56
514898 [CIMARON4    138.00] AMP    42021.4   -84.99
514907 [ARCADIA4    138.00] AMP    40842.6   -85.63
514909 [REDBUD 7    345.00] AMP    23853.8   -86.78
514934 [DRAPER 7    345.00] AMP    20389.5   -85.14
515045 [SEMINOL7    345.00] AMP    25941.6   -86.18
515181 [UNVRSTY4    138.00] AMP    13444.6   -79.90
515400 [DMANCRK4    138.00] AMP     7972.7   -80.19
515407 [TATONGA7    345.00] AMP    10482.3   -86.78
515471 [NW164TH4    138.00] AMP    34845.0   -85.66
515477 [CHSHLMV7    345.00] AMP    12066.1   -84.69
515512 [SPVALLY4    138.00] AMP     8677.6   -77.82
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
515610 [FSHRTAP7    345.00] AMP    15917.8   -85.09
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
584900 [GEN-2015-052345.00] AMP    13100.6   -86.43
585010 [GEN-2015-063345.00] AMP    16485.7   -84.83
300140 [4SILVCTY    138.00] AMP    15805.4   -82.23
300996 [4JAVINE     138.00] AMP     6534.2   -82.68
301429 [4CLEVLNDXFMR138.00] AMP    16793.2   -85.46
509757 [WEKIWA-4    138.00] AMP    31277.7   -84.88
509782 [R.S.S.-7    345.00] AMP    30823.7   -86.91
509807 [ONETA--7    345.00] AMP    29582.0   -86.67
509817 [T.NO.--4    138.00] AMP    34296.1   -84.89
509870 [SAPLPRD7    345.00] AMP    21085.5   -86.50
510377 [FAIRFXT4    138.00] AMP     8207.8   -79.18
510380 [DELWARE7    345.00] AMP    11399.5   -84.84
510432 [SHIDWFC4    138.00] AMP     5667.0   -76.08
510907 [PITTSB-7    345.00] AMP    13067.7   -84.54
511425 [TUTCONT4    138.00] AMP    10456.4   -80.80
512650 [GRDA1  7    345.00] AMP    26001.9   -87.32
512749 [PAWNSW4     138.00] AMP    10200.9   -83.76
514710 [WAUKOMI4    138.00] AMP     9516.0   -80.46
514712 [FAIRMON4    138.00] AMP    13634.2   -82.23
514731 [SO4TH  4    138.00] AMP    14806.9   -81.22
514748 [CONTEMP4    138.00] AMP    12936.4   -81.64
514753 [CONORTH4    138.00] AMP    12978.2   -81.64
514760 [KILDARE4    138.00] AMP    10167.9   -79.50
514768 [WF KAY 2    69.000] AMP     2949.6   -81.29
514819 [EL-RENO4    138.00] AMP    15218.5   -80.01
514820 [JENSENT4    138.00] AMP    14995.6   -79.44
514827 [CTNWOOD4    138.00] AMP    16556.1   -80.43
514834 [KETCH  4    138.00] AMP    26479.2   -84.56
514851 [QUAILCK4    138.00] AMP    28916.6   -83.27
514852 [SLVRLAK4    138.00] AMP    32141.2   -83.89
514863 [HAYMAKR4    138.00] AMP    26007.0   -82.45
514864 [PIEDMNT4    138.00] AMP    22045.6   -84.44
514894 [CZECHAL4    138.00] AMP    28013.5   -82.98
514895 [SARA   4    138.00] AMP    18582.2   -84.09
514906 [JNSKAMO4    138.00] AMP    20536.4   -81.91
514933 [DRAPER 4    138.00] AMP    38576.3   -85.17
515009 [MCELROY4    138.00] AMP    13562.0   -79.76
515039 [PAYNESB4    138.00] AMP     7625.9   -77.28
515044 [SEMINOL4    138.00] AMP    39196.8   -85.70
515224 [MUSKOGE7    345.00] AMP    28789.9   -86.76
515402 [CONBLKT2    69.000] AMP    13329.3   -82.81
515444 [MCNOWND7    345.00] AMP    16121.2   -85.14
515448 [CRSRDSW7    345.00] AMP     8151.4   -85.99
515461 [RNDBARN4    138.00] AMP    38851.6   -85.56
515465 [LGARBER4    138.00] AMP    21023.9   -82.40
515466 [MITCHSB4    138.00] AMP    21067.1   -83.35
515514 [KNIPE  4    138.00] AMP     5020.0   -78.92
515542 [CWBOYHT4    138.00] AMP     7871.1   -74.40
515544 [RENFROW4    138.00] AMP    13395.3   -84.84
515549 [MNCWND37    345.00] AMP    11273.6   -84.89
515582 [SLNGWND7    345.00] AMP     7041.8   -85.75
515585 [MAMTHPW7    345.00] AMP     9281.6   -86.61
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515600 [KNGFSHR7    345.00] AMP    11007.1   -84.89
515605 [CANADN7     345.00] AMP    11348.5   -84.82
515800 [GRACMNT7    345.00] AMP    14766.5   -85.23
521006 [MARSHAL4    138.00] AMP     7747.8   -80.47
521007 [MARLAND_138 138.00] AMP     7271.8   -74.50
521100 [WARREN 4    138.00] AMP     8658.7   -82.14
529241 [OMMORANT    69.000] AMP     9155.5   -83.30
529249 [OMWW        69.000] AMP    11293.1   -83.58
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532798 [VIOLA   7   345.00] AMP    11406.1   -85.09
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
533062 [ROSEHIL4    138.00] AMP    31012.2   -86.17
560077 [G16-032-TAP 345.00] AMP     3367.1   -79.62
562075 [G15-081-TAP 345.00] AMP    11375.5   -86.55
583750 [GEN-2013-029345.00] AMP     9999.0   -84.60
584170 [GEN-2014-064138.00] AMP     9448.7   -82.38
584700 [GEN-2015-029345.00] AMP     7355.2   -85.26
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:53
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
514803 [SOONER 7    345.00] AMP    24819.4   -86.49
514802 [SOONER 4    138.00] AMP    31906.3   -86.80
514881 [SPRNGCK7    345.00] AMP    21906.6   -85.52
515576 [RANCHRD7    345.00] AMP    13911.7   -86.68
560056 [G15-066T    345.00] AMP    18088.8   -86.54
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
584690 [GEN-2015-030345.00] AMP    18861.8   -85.91
584880 [GEN-2015-047345.00] AMP    11045.5   -83.64
512694 [CLEVLND7    345.00] AMP    14920.4   -86.34
514704 [MILLERT4    138.00] AMP    20472.7   -85.60
514707 [PERRY  4    138.00] AMP    11017.4   -83.26
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
514798 [SNRPMPT4    138.00] AMP    20526.7   -85.58
514880 [NORTWST7    345.00] AMP    30523.4   -86.08
515447 [MORISNT4    138.00] AMP    13886.8   -82.89
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
529200 [OMCDLEC7    345.00] AMP    13885.7   -86.67
584450 [G1501-G1631 345.00] AMP    11161.1   -85.62
584770 [GEN-2015-034345.00] AMP    11840.1   -86.25
585040 [GEN-2015-066345.00] AMP    17921.7   -86.52
509852 [T.NO.--7    345.00] AMP    23628.4   -86.30
512729 [CLEVLND 4   138.00] AMP    16838.3   -85.48
514706 [COWCRK 4    138.00] AMP    11321.7   -82.96
514714 [WOODRNG4    138.00] AMP    18755.9   -83.28
514737 [OTOE   4    138.00] AMP    16309.3   -83.27
514743 [OSAGE  4    138.00] AMP    16704.4   -81.98
514799 [SNRPMP 4    138.00] AMP    11293.5   -80.54
514825 [KAYWIND7    345.00] AMP    12832.5   -86.64
514879 [NORTWST4    138.00] AMP    42925.0   -85.97
514901 [CIMARON7    345.00] AMP    31112.9   -85.94
514908 [ARCADIA7    345.00] AMP    26069.9   -86.55
515006 [MORRISN4    138.00] AMP    13855.3   -82.89
515011 [STILWTR4    138.00] AMP    13902.4   -80.02
515412 [DMNCRKT4    138.00] AMP    13761.8   -84.38
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515497 [MATHWSN7    345.00] AMP    29657.1   -86.07
560053 [G15-052T    345.00] AMP    13222.6   -86.46
560055 [G15-063T    345.00] AMP    17188.7   -84.94
300138 [4CLEVLND    138.00] AMP    16840.8   -85.46
509755 [WEKIWA-7    345.00] AMP    18794.5   -86.22
509895 [T.NO.2-4    138.00] AMP    34421.2   -84.97
510376 [WEBBTAP4    138.00] AMP     8253.5   -79.08
510406 [N.E.S.-7    345.00] AMP    18851.5   -86.42
512865 [GREC TAP5   345.00] AMP    25892.4   -87.33
514705 [COWCRK 2    69.000] AMP     4049.0   -86.74
514708 [OTTER  4    138.00] AMP     9550.1   -82.39
514709 [FRMNTAP4    138.00] AMP    17566.5   -82.86
514711 [WAUKOTP4    138.00] AMP    15017.2   -81.71
514713 [WRVALLY4    138.00] AMP     8694.6   -82.12
514733 [MARSHL 4    138.00] AMP     7801.1   -80.52
514742 [OSGE   2    69.000] AMP    17574.7   -84.60
514758 [STDBEAR4    138.00] AMP    13945.6   -81.82
514761 [WHEAGLE4    138.00] AMP    15727.2   -81.86
514770 [MARLNDT4    138.00] AMP    10967.6   -76.88
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514801 [MINCO  7    345.00] AMP    16528.1   -85.20
514828 [KETCHTP4    138.00] AMP    26063.9   -84.56
514854 [BRADEN 4    138.00] AMP    30928.2   -85.16
514873 [LNEOAK 4    138.00] AMP    26553.9   -84.59
514898 [CIMARON4    138.00] AMP    42376.5   -85.06
514907 [ARCADIA4    138.00] AMP    41271.5   -85.71
514909 [REDBUD 7    345.00] AMP    25389.3   -86.83
514934 [DRAPER 7    345.00] AMP    20544.1   -85.12
515045 [SEMINOL7    345.00] AMP    26110.6   -86.15
515181 [UNVRSTY4    138.00] AMP    13740.1   -79.82
515400 [DMANCRK4    138.00] AMP     8063.5   -80.18
515407 [TATONGA7    345.00] AMP    15928.8   -86.55
515471 [NW164TH4    138.00] AMP    35153.6   -85.69
515477 [CHSHLMV7    345.00] AMP    12423.3   -84.73
515512 [SPVALLY4    138.00] AMP     8870.7   -77.69
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
515610 [FSHRTAP7    345.00] AMP    16266.6   -85.14
515644 [STLWTR2     69.000] AMP    16292.2   -78.23
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
584900 [GEN-2015-052345.00] AMP    13171.6   -86.44
585010 [GEN-2015-063345.00] AMP    16901.5   -84.88
300140 [4SILVCTY    138.00] AMP    15887.3   -82.25
300996 [4JAVINE     138.00] AMP     6541.0   -82.68
301429 [4CLEVLNDXFMR138.00] AMP    16840.8   -85.46
509757 [WEKIWA-4    138.00] AMP    31532.2   -84.88
509782 [R.S.S.-7    345.00] AMP    31506.4   -86.98
509807 [ONETA--7    345.00] AMP    29977.3   -86.69
509817 [T.NO.--4    138.00] AMP    34481.1   -84.88
509870 [SAPLPRD7    345.00] AMP    21389.3   -86.54
510377 [FAIRFXT4    138.00] AMP     8306.8   -79.18
510380 [DELWARE7    345.00] AMP    11497.3   -84.87
510432 [SHIDWFC4    138.00] AMP     5714.3   -76.04
510907 [PITTSB-7    345.00] AMP    13104.8   -84.54
511425 [TUTCONT4    138.00] AMP    10525.1   -80.78
512650 [GRDA1  7    345.00] AMP    26341.5   -87.33
512662 [STILWTP2    69.000] AMP    16307.3   -78.22
512749 [PAWNSW4     138.00] AMP    10231.7   -83.77
514710 [WAUKOMI4    138.00] AMP     9564.7   -80.48
514712 [FAIRMON4    138.00] AMP    13706.2   -82.21
514731 [SO4TH  4    138.00] AMP    14888.2   -81.20
514748 [CONTEMP4    138.00] AMP    13537.6   -81.79
514753 [CONORTH4    138.00] AMP    13589.8   -81.79
514760 [KILDARE4    138.00] AMP    10538.8   -79.40
514768 [WF KAY 2    69.000] AMP     2952.2   -81.29
514819 [EL-RENO4    138.00] AMP    15282.6   -80.04
514820 [JENSENT4    138.00] AMP    15059.3   -79.45
514827 [CTNWOOD4    138.00] AMP    16608.1   -80.43
514834 [KETCH  4    138.00] AMP    26522.7   -84.56
514851 [QUAILCK4    138.00] AMP    28977.6   -83.27
514852 [SLVRLAK4    138.00] AMP    32243.4   -83.91
514863 [HAYMAKR4    138.00] AMP    26063.0   -82.47
514864 [PIEDMNT4    138.00] AMP    22137.3   -84.46
514894 [CZECHAL4    138.00] AMP    27689.8   -83.00
514895 [SARA   4    138.00] AMP    18615.0   -84.10
514906 [JNSKAMO4    138.00] AMP    20328.0   -81.87
514933 [DRAPER 4    138.00] AMP    38625.6   -85.15
515009 [MCELROY4    138.00] AMP    13765.4   -79.70
515039 [PAYNESB4    138.00] AMP     7757.1   -77.17
515044 [SEMINOL4    138.00] AMP    39329.5   -85.67
515224 [MUSKOGE7    345.00] AMP    28898.4   -86.76
515402 [CONBLKT2    69.000] AMP    15570.3   -82.73
515444 [MCNOWND7    345.00] AMP    16481.0   -85.19
515448 [CRSRDSW7    345.00] AMP    11102.8   -85.54
515461 [RNDBARN4    138.00] AMP    39231.1   -85.63
515465 [LGARBER4    138.00] AMP    20999.6   -82.39
515466 [MITCHSB4    138.00] AMP    21103.6   -83.35
515514 [KNIPE  4    138.00] AMP     5084.2   -78.86
515542 [CWBOYHT4    138.00] AMP     8033.4   -74.32
515544 [RENFROW4    138.00] AMP    13620.0   -84.90
515549 [MNCWND37    345.00] AMP    11439.8   -84.91
515582 [SLNGWND7    345.00] AMP     8983.5   -85.26
515585 [MAMTHPW7    345.00] AMP    13253.8   -86.34
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515600 [KNGFSHR7    345.00] AMP    11158.5   -84.92
515605 [CANADN7     345.00] AMP    11520.0   -84.86
515800 [GRACMNT7    345.00] AMP    15201.3   -85.32
521006 [MARSHAL4    138.00] AMP     7764.7   -80.47
521007 [MARLAND_138 138.00] AMP     7447.5   -74.42
521100 [WARREN 4    138.00] AMP     8694.6   -82.12
529241 [OMMORANT    69.000] AMP    12322.0   -84.32
529249 [OMWW        69.000] AMP    13347.1   -83.72
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
560077 [G16-032-TAP 345.00] AMP     3373.3   -79.62
562075 [G15-081-TAP 345.00] AMP    16229.8   -86.40
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
584170 [GEN-2014-064138.00] AMP     9477.5   -82.36
584700 [GEN-2015-029345.00] AMP     9603.1   -84.60
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GEN-2015-052 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:01
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560053 [G15-052T    345.00] AMP    13151.1   -86.46
515621 [OPENSKY7    345.00] AMP    12828.8   -86.64
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
584900 [GEN-2015-052345.00] AMP    13100.6   -86.43
514825 [KAYWIND7    345.00] AMP    12795.3   -86.64
515576 [RANCHRD7    345.00] AMP    13873.1   -86.68
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
533062 [ROSEHIL4    138.00] AMP    31012.2   -86.17
514803 [SOONER 7    345.00] AMP    24626.1   -86.49
529200 [OMCDLEC7    345.00] AMP    13847.3   -86.67
532780 [CANEYRV7    345.00] AMP     9890.8   -85.50
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
532799 [WAVERLY7    345.00] AMP    14714.1   -86.51
532801 [ELKRVR17    345.00] AMP     9239.4   -85.46
532986 [BENTON 4    138.00] AMP    27920.3   -85.85
532991 [WEAVER 4    138.00] AMP    21770.4   -83.96
533039 [ELPASO 4    138.00] AMP    24353.8   -84.19
533068 [STEARMN4    138.00] AMP    19364.9   -84.21
533653 [WOLFCRK2    69.000] AMP     5807.4   -87.18
584450 [G1501-G1631 345.00] AMP    11137.1   -85.62
584770 [GEN-2015-034345.00] AMP    11812.8   -86.26
514802 [SOONER 4    138.00] AMP    31411.9   -86.77
514881 [SPRNGCK7    345.00] AMP    21411.7   -85.53
532771 [RENO   7    345.00] AMP    10664.8   -85.60
532781 [CANEYWF7    345.00] AMP     9626.9   -85.46
532793 [NEOSHO 7    345.00] AMP    16212.3   -84.49
532798 [VIOLA   7   345.00] AMP    11406.1   -85.09
532802 [WAVERTX7    345.00] AMP    12557.2   -86.05
532988 [BELAIRE4    138.00] AMP    18644.7   -84.79
532990 [MIDIAN 4    138.00] AMP    10064.0   -80.49
532993 [TALLGRS4    138.00] AMP     9974.9   -79.23
533024 [29TH   4    138.00] AMP    19407.6   -85.11
533026 [ANDOVER4    138.00] AMP    17621.1   -84.15
533029 [59TH ST4    138.00] AMP    17279.0   -83.56
533030 [BOEING 4    138.00] AMP    16809.7   -83.81
533032 [BU11PON4    138.00] AMP    14859.8   -80.39
533035 [CHISHLM4    138.00] AMP    21792.8   -84.81
533040 [EVANS N4    138.00] AMP    37046.2   -87.18
533042 [FARBER 4    138.00] AMP    15552.0   -83.79
533066 [64TH   4    138.00] AMP    14141.5   -82.99
533067 [SPRNGDL4    138.00] AMP    14308.8   -83.06
533604 [WEAVER 2    69.000] AMP    11614.9   -85.82
533626 [BURLJCT2    69.000] AMP     4774.0   -85.78
533629 [CC2SHAR2    69.000] AMP     4514.5   -81.43
533793 [ELPASO 2    69.000] AMP    11687.8   -83.08
542981 [LACYGNE7    345.00] AMP    24953.9   -86.88
560033 [G1524&G1525T345.00] AMP    19098.2   -86.29
560056 [G15-066T    345.00] AMP    17997.4   -86.55
560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
562476 [G14-001-TAP 345.00] AMP    10937.6   -85.04
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584690 [GEN-2015-030345.00] AMP    18751.0   -85.92
584880 [GEN-2015-047345.00] AMP    11012.1   -83.66
300739 [7BLACKBERRY 345.00] AMP    12256.2   -84.36
510380 [DELWARE7    345.00] AMP    11399.5   -84.84
512694 [CLEVLND7    345.00] AMP    14858.5   -86.35
514704 [MILLERT4    138.00] AMP    20178.4   -85.57
514707 [PERRY  4    138.00] AMP    10947.5   -83.28
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
514798 [SNRPMPT4    138.00] AMP    20201.9   -85.53
514880 [NORTWST7    345.00] AMP    29354.6   -86.04
515447 [MORISNT4    138.00] AMP    13669.6   -82.93
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
532768 [EMPEC 7     345.00] AMP    17266.2   -86.19
532773 [SUMMIT 7    345.00] AMP    10227.0   -85.73
532792 [FR2EAST7    345.00] AMP     6213.4   -85.59
532937 [NEOSHO 5    161.00] AMP    22018.1   -84.25
532987 [BUTLER 4    138.00] AMP     9877.9   -79.44
532989 [BUTLERS4    138.00] AMP     9877.9   -79.44
533021 [NEOSHO 4    138.00] AMP    23058.0   -84.46
533028 [BEECHTP4    138.00] AMP    13423.0   -82.63
533031 [BURNSTP4    138.00] AMP     4470.1   -76.64
533033 [CANAL  4    138.00] AMP    16360.9   -83.95
533037 [COMOTAR4    138.00] AMP    18402.0   -84.62
533041 [EVANS S4    138.00] AMP    37046.2   -87.18
533046 [GILL S 4    138.00] AMP    21928.3   -84.55
533048 [HARRY  4    138.00] AMP    13403.8   -82.76
533060 [NOEASTE4    138.00] AMP    20291.2   -84.75
533063 [SC10BEL4    138.00] AMP     8715.4   -81.32
533064 [17TH   4    138.00] AMP    17543.0   -84.54
533065 [SG12COL4    138.00] AMP    20144.7   -85.76
533390 [MAIZEW 4    138.00] AMP    25938.3   -85.53
533391 [MAIZEE 4    138.00] AMP    20951.8   -85.00
533416 [RENO   3    115.00] AMP    21529.6   -85.57
533585 [BU10BEN2    69.000] AMP    10436.6   -84.92
533597 [MIDIAN 2    69.000] AMP    12202.5   -81.94
533624 [BURLING2    69.000] AMP     3313.7   -82.08
533630 [CC3WEST2    69.000] AMP     4386.8   -85.15
533786 [CHISHLM2    69.000] AMP    18509.0   -85.40
533821 [MULVANE2    69.000] AMP     5333.0   -78.00
533824 [OAKLAWN2    69.000] AMP    15422.2   -78.54
533837 [RH JCT 2    69.000] AMP     6512.7   -84.32
533842 [64TH   2    69.000] AMP    14570.8   -84.52
539801 [THISTLE7    345.00] AMP    15217.3   -85.86
542965 [W.GRDNR7    345.00] AMP    25257.1   -85.83
542968 [STILWEL7    345.00] AMP    24271.7   -85.88
583850 [GEN-2014-001345.00] AMP     7500.6   -84.76
584659 [G15024G15025345.00] AMP     6723.0   -86.50
585040 [GEN-2015-066345.00] AMP    17832.1   -86.52
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:54
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
560053 [G15-052T    345.00] AMP    13222.6   -86.46
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
532780 [CANEYRV7    345.00] AMP     9934.8   -85.50
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
532799 [WAVERLY7    345.00] AMP    14765.6   -86.51
532801 [ELKRVR17    345.00] AMP     9282.6   -85.46
532986 [BENTON 4    138.00] AMP    28467.8   -85.82
532991 [WEAVER 4    138.00] AMP    22302.1   -83.88
533039 [ELPASO 4    138.00] AMP    25627.9   -84.16
533068 [STEARMN4    138.00] AMP    19919.5   -84.15
533653 [WOLFCRK2    69.000] AMP     6015.6   -87.23
584900 [GEN-2015-052345.00] AMP    13171.6   -86.44
514825 [KAYWIND7    345.00] AMP    12832.5   -86.64
515576 [RANCHRD7    345.00] AMP    13911.7   -86.68
532771 [RENO   7    345.00] AMP    11452.3   -85.98
532781 [CANEYWF7    345.00] AMP     9668.3   -85.46
532793 [NEOSHO 7    345.00] AMP    16305.9   -84.49
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
532802 [WAVERTX7    345.00] AMP    12593.9   -86.05
532988 [BELAIRE4    138.00] AMP    18912.7   -84.75
532990 [MIDIAN 4    138.00] AMP    10161.1   -80.42
532993 [TALLGRS4    138.00] AMP    10076.3   -79.15
533024 [29TH   4    138.00] AMP    19696.3   -85.08
533026 [ANDOVER4    138.00] AMP    17928.3   -84.09
533029 [59TH ST4    138.00] AMP    18965.7   -83.67
533030 [BOEING 4    138.00] AMP    17232.3   -83.76
533032 [BU11PON4    138.00] AMP    15179.0   -80.27
533035 [CHISHLM4    138.00] AMP    22463.6   -84.76
533040 [EVANS N4    138.00] AMP    42055.0   -87.26
533042 [FARBER 4    138.00] AMP    16424.6   -83.72
533066 [64TH   4    138.00] AMP    14462.1   -82.99
533067 [SPRNGDL4    138.00] AMP    14575.4   -83.01
533604 [WEAVER 2    69.000] AMP    11753.1   -85.83
533626 [BURLJCT2    69.000] AMP     5025.4   -85.90
533629 [CC2SHAR2    69.000] AMP     4638.9   -81.31
533793 [ELPASO 2    69.000] AMP    11846.9   -83.18
542981 [LACYGNE7    345.00] AMP    25072.0   -86.87
560033 [G1524&G1525T345.00] AMP    19635.1   -86.39
562476 [G14-001-TAP 345.00] AMP    11039.2   -85.05
300739 [7BLACKBERRY 345.00] AMP    12268.7   -84.36
510380 [DELWARE7    345.00] AMP    11497.3   -84.87
514803 [SOONER 7    345.00] AMP    24819.4   -86.49
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
529200 [OMCDLEC7    345.00] AMP    13885.7   -86.67
532768 [EMPEC 7     345.00] AMP    17379.0   -86.18
532773 [SUMMIT 7    345.00] AMP    10596.8   -85.91
532792 [FR2EAST7    345.00] AMP     6648.7   -85.72
532937 [NEOSHO 5    161.00] AMP    22132.2   -84.26
532987 [BUTLER 4    138.00] AMP     9979.1   -79.37
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532989 [BUTLERS4    138.00] AMP    9979.1   -79.37
533021 [NEOSHO 4    138.00] AMP   23262.2   -84.41
533028 [BEECHTP4    138.00] AMP   13677.4   -82.59
533031 [BURNSTP4    138.00] AMP    4488.9   -76.59
533033 [CANAL  4    138.00] AMP   16780.7   -83.93
533037 [COMOTAR4    138.00] AMP   18675.0   -84.58
533041 [EVANS S4    138.00] AMP   42055.0   -87.26
533046 [GILL S 4    138.00] AMP   28372.2   -85.43
533048 [HARRY  4    138.00] AMP   13669.9   -82.74
533060 [NOEASTE4    138.00] AMP   20644.7   -84.71
533063 [SC10BEL4    138.00] AMP   10219.1   -81.97
533064 [17TH   4    138.00] AMP   18000.7   -84.51
533065 [SG12COL4    138.00] AMP   21501.5   -85.71
533075 [VIOLA  4    138.00] AMP   22048.6   -86.03
533390 [MAIZEW 4    138.00] AMP   27866.0   -85.44
533391 [MAIZEE 4    138.00] AMP   21891.6   -84.94
533416 [RENO   3    115.00] AMP   25051.7   -86.11
533585 [BU10BEN2    69.000] AMP   10547.4   -84.92
533597 [MIDIAN 2    69.000] AMP   12285.0   -81.91
533624 [BURLING2    69.000] AMP    3494.1   -82.29
533630 [CC3WEST2    69.000] AMP    4627.1   -85.28
533786 [CHISHLM2    69.000] AMP   18791.8   -85.38
533821 [MULVANE2    69.000] AMP    5366.1   -78.01
533824 [OAKLAWN2    69.000] AMP   15709.0   -79.07
533837 [RH JCT 2    69.000] AMP    6618.6   -84.37
533842 [64TH   2    69.000] AMP   14771.2   -84.90
539801 [THISTLE7    345.00] AMP   15582.5   -85.88
542965 [W.GRDNR7    345.00] AMP   25940.5   -85.83
542968 [STILWEL7    345.00] AMP   24405.9   -85.85
583850 [GEN-2014-001345.00] AMP    7544.4   -84.77
584450 [G1501-G1631 345.00] AMP   11161.1   -85.62
584659 [G15024G15025345.00] AMP    6773.6   -86.53
584770 [GEN-2015-034345.00] AMP   11840.1   -86.25
300740 [7SPORTSMAN  345.00] AMP   23813.1   -87.05
300949 [7JASPER     345.00] AMP   10652.6   -83.97
510379 [DELWARE4    138.00] AMP   11037.0   -86.74
510406 [N.E.S.-7    345.00] AMP   18851.5   -86.42
514802 [SOONER 4    138.00] AMP   31906.3   -86.80
514881 [SPRNGCK7    345.00] AMP   21906.6   -85.52
515375 [WWRDEHV7    345.00] AMP   19024.8   -86.11
515476 [HUNTERS7    345.00] AMP   12440.3   -84.73
515544 [RENFROW4    138.00] AMP   13620.0   -84.90
532767 [BLUSTEM7    345.00] AMP    9735.6   -86.29
532769 [LANG   7    345.00] AMP   17165.9   -86.17
532770 [MORRIS 7    345.00] AMP   12789.6   -85.53
532774 [SWISVAL7    345.00] AMP   16646.6   -85.36
532776 [DOUGLAS7    345.00] AMP   18181.4   -85.14
532795 [FR2WEST7    345.00] AMP    5480.9   -85.75
532873 [SUMMIT 6    230.00] AMP   13472.6   -85.34
532926 [BAKER  5    161.00] AMP    8445.6   -81.47
532934 [MARMTNE5    161.00] AMP    8867.4   -80.08
532984 [SUMNER 4    138.00] AMP   10235.1   -82.94
533001 [ALTOONA4    138.00] AMP    8684.8   -75.06
533015 [BENTLEY4    138.00] AMP   10120.0   -85.06
533020 [NEOSHOS4    138.00] AMP   23262.2   -84.41
533022 [NEOSHON4    138.00] AMP   23262.2   -84.41
533027 [BEECH  4    138.00] AMP   12218.5   -82.44
533036 [CLEARWT4    138.00] AMP   21761.5   -85.40
533043 [FOWLER 4    138.00] AMP   16502.3   -84.00
533045 [GILL W 4    138.00] AMP   28372.2   -85.43
533053 [LAKERDG4    138.00] AMP   18964.1   -85.56
533054 [MAIZE  4    138.00] AMP   23383.8   -85.11
533069 [TCBURNS4    138.00] AMP    3249.3   -78.61
533074 [45TH ST4    138.00] AMP   29218.3   -86.41
533413 [CIRCLE 3    115.00] AMP   22707.4   -85.87
533415 [DAVIS  3    115.00] AMP    8740.9   -82.40
533429 [MOUNDRG3    115.00] AMP    7183.3   -83.13
533438 [WMCPHER3    115.00] AMP   12423.9   -84.78
533550 [RICHLAN2    69.000] AMP    5900.1   -84.04
533583 [BUTLER 2    69.000] AMP   12562.5   -81.90
533587 [CHASJCT2    69.000] AMP    9898.6   -82.20
533589 [CHESNEY2    69.000] AMP    8352.4   -80.30
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533598 [MOBIL  2    69.000] AMP     7507.7   -82.57
533607 [TOWTAPE2    69.000] AMP     5672.0   -71.60
533608 [POTWNTP2    69.000] AMP     5230.5   -75.69
533625 [BURLIND2    69.000] AMP     3103.7   -81.50
533628 [CC1BURL2    69.000] AMP     3479.7   -82.32
533636 [GREEN  2    69.000] AMP     4090.3   -83.73
533768 [NEOSHO 2    69.000] AMP    18743.4   -86.13
533784 [CANAL  2    69.000] AMP    20725.9   -83.07
533792 [EASTBOR2    69.000] AMP    14680.2   -84.02
533795 [GILL E 2    69.000] AMP    33847.5   -85.47
533796 [GILL W 2    69.000] AMP    33847.5   -85.47
533799 [GRANT  2    69.000] AMP    10747.1   -83.80
533808 [HYDRJN2     69.000] AMP    16113.8   -77.84
533822 [NOEASTE2    69.000] AMP    25232.3   -84.40
533826 [OLIVER 2    69.000] AMP    14117.1   -80.59
533832 [RIPLEYM2    69.000] AMP    21908.7   -83.88
533836 [ROSEHIL2    69.000] AMP     5406.4   -78.60
533840 [17TH   2    69.000] AMP    27855.3   -83.17
533880 [GODDARD2    138.00] AMP    18934.8   -85.91
539804 [THISTLE4    138.00] AMP    16466.9   -86.37
539805 [ELMCREEK7   345.00] AMP     5312.0   -85.44
541198 [PECULR 7    345.00] AMP    20157.7   -85.60
542966 [WGARDNR5    161.00] AMP    27438.2   -86.93
542969 [STILWEL5    161.00] AMP    38873.3   -85.82
542977 [CRAIG  7    345.00] AMP    21943.2   -85.75
547469 [RIV4525     161.00] AMP    23413.9   -83.40
560056 [G15-066T    345.00] AMP    18088.8   -86.54
560072 [G16-005-TAP 345.00] AMP    11874.9   -85.29
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
584660 [GEN-2015-024345.00] AMP     5625.2   -86.55
584670 [GEN-2015-025345.00] AMP     6773.6   -86.53
584690 [GEN-2015-030345.00] AMP    18861.8   -85.91
584880 [GEN-2015-047345.00] AMP    11045.5   -83.64
585100 [GEN-2015-073345.00] AMP    14235.6   -85.64
585200 [GEN-2015-083138.00] AMP     7093.1   -80.69
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GEN-2015-062 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:01
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
514815 [BRECKNR4    138.00] AMP    13481.0   -80.99
514642 [BRCKWND4    138.00] AMP     7313.0   -81.47
514701 [BUNCHCK4    138.00] AMP     6496.7   -73.27
514731 [SO4TH  4    138.00] AMP    14806.9   -81.22
515383 [ENIDINT4    138.00] AMP    12640.4   -80.95
515641 [PLNSMEN4    138.00] AMP    13493.0   -82.03
514709 [FRMNTAP4    138.00] AMP    17455.5   -82.87
514711 [WAUKOTP4    138.00] AMP    14930.9   -81.71
514712 [FAIRMON4    138.00] AMP    13634.2   -82.23
514730 [SO4TH  2    69.000] AMP    13548.5   -82.36
514790 [IMO    4    138.00] AMP    11621.3   -80.85
515552 [NRTHSTR4    138.00] AMP    12164.8   -80.95
515635 [BLLNGTP4    138.00] AMP     6489.3   -73.25
515737 [ENIDIND4    138.00] AMP     9571.7   -80.71
514710 [WAUKOMI4    138.00] AMP     9516.0   -80.46
514714 [WOODRNG4    138.00] AMP    18630.9   -83.29
514718 [VANCE  2    69.000] AMP     6952.8   -72.23
514721 [IMO    2    69.000] AMP    11782.3   -82.34
514722 [CLEVETP2    69.000] AMP    11565.5   -81.88
514727 [ENID   2    69.000] AMP    11824.6   -79.85
514734 [GLENWD 4    138.00] AMP    10067.6   -80.80
514769 [NE ENID4    138.00] AMP     9923.9   -80.88
514789 [MENOTAP4    138.00] AMP     7022.4   -79.80
515403 [FNTANTP4    138.00] AMP     6731.9   -73.40
515456 [CHSTNTT2    69.000] AMP    11468.4   -79.64
520836 [BILLING4    138.00] AMP     6431.0   -73.22
514708 [OTTER  4    138.00] AMP     9520.8   -82.41
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
514723 [CLEVLND2    69.000] AMP     9153.6   -80.22
514725 [HEMLKTP2    69.000] AMP    11322.7   -79.56
514726 [CHSTNUT2    69.000] AMP    11189.5   -79.47
514732 [NE ENID2    69.000] AMP    10984.6   -80.27
514733 [MARSHL 4    138.00] AMP     7784.1   -80.53
514774 [HENESEY4    138.00] AMP     7312.2   -79.09
515493 [GOLTYTP2    69.000] AMP     3553.3   -68.25
515542 [CWBOYHT4    138.00] AMP     7871.1   -74.40
515562 [CLEOPLT4    138.00] AMP     6410.6   -77.93
520432 [FOUNTAIN4   138.00] AMP     5127.3   -72.41
514713 [WRVALLY4    138.00] AMP     8658.7   -82.14
514720 [GOLTRY 2    69.000] AMP     3541.4   -68.24
514724 [HEMLOCK2    69.000] AMP     7724.0   -79.62
514770 [MARLNDT4    138.00] AMP    10590.1   -76.91
514778 [CLEOCOR4    138.00] AMP     6414.0   -77.92
515371 [HELENAT2    69.000] AMP     3093.7   -67.78
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515501 [KREMLNT2    69.000] AMP     4908.2   -70.12
515541 [COWBOYH4    138.00] AMP     7317.0   -74.83
515553 [CLEO PL4    138.00] AMP     5381.8   -78.21
520882 [DOVERSW4    138.00] AMP     7378.9   -78.26
521006 [MARSHAL4    138.00] AMP     7747.8   -80.47
560055 [G15-063T    345.00] AMP    16757.8   -84.89
560077 [G16-032-TAP 345.00] AMP     3367.1   -79.62
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560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
584170 [GEN-2014-064138.00] AMP     9448.7   -82.38
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:54
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
514815 [BRECKNR4    138.00] AMP    13554.7   -80.96
514642 [BRCKWND4    138.00] AMP     7333.2   -81.46
514701 [BUNCHCK4    138.00] AMP     6555.1   -73.20
514731 [SO4TH  4    138.00] AMP    14888.2   -81.20
515383 [ENIDINT4    138.00] AMP    12704.8   -80.93
515641 [PLNSMEN4    138.00] AMP    13564.2   -82.01
514709 [FRMNTAP4    138.00] AMP    17566.5   -82.86
514711 [WAUKOTP4    138.00] AMP    15017.2   -81.71
514712 [FAIRMON4    138.00] AMP    13706.2   -82.21
514730 [SO4TH  2    69.000] AMP    13582.3   -82.36
514790 [IMO    4    138.00] AMP    11667.5   -80.83
515552 [NRTHSTR4    138.00] AMP    12224.1   -80.93
515635 [BLLNGTP4    138.00] AMP     6550.3   -73.17
515737 [ENIDIND4    138.00] AMP     9608.5   -80.69
514710 [WAUKOMI4    138.00] AMP     9564.7   -80.48
514714 [WOODRNG4    138.00] AMP    18755.9   -83.28
514718 [VANCE  2    69.000] AMP     6961.5   -72.21
514721 [IMO    2    69.000] AMP    11806.3   -82.34
514722 [CLEVETP2    69.000] AMP    11589.5   -81.87
514727 [ENID   2    69.000] AMP    11850.3   -79.84
514734 [GLENWD 4    138.00] AMP    10103.2   -80.78
514769 [NE ENID4    138.00] AMP     9961.4   -80.86
514789 [MENOTAP4    138.00] AMP     7034.3   -79.79
515403 [FNTANTP4    138.00] AMP     6819.5   -73.32
515456 [CHSTNTT2    69.000] AMP    11493.2   -79.62
520836 [BILLING4    138.00] AMP     6490.9   -73.15
514708 [OTTER  4    138.00] AMP     9550.1   -82.39
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
514723 [CLEVLND2    69.000] AMP     9168.5   -80.21
514725 [HEMLKTP2    69.000] AMP    11346.9   -79.54
514726 [CHSTNUT2    69.000] AMP    11213.1   -79.46
514732 [NE ENID2    69.000] AMP    11008.3   -80.26
514733 [MARSHL 4    138.00] AMP     7801.1   -80.52
514774 [HENESEY4    138.00] AMP     7368.8   -79.16
515493 [GOLTYTP2    69.000] AMP     3555.3   -68.23
515542 [CWBOYHT4    138.00] AMP     8033.4   -74.32
515562 [CLEOPLT4    138.00] AMP     6416.9   -77.92
520432 [FOUNTAIN4   138.00] AMP     5177.9   -72.34
514713 [WRVALLY4    138.00] AMP     8694.6   -82.12
514720 [GOLTRY 2    69.000] AMP     3543.4   -68.23
514724 [HEMLOCK2    69.000] AMP     7735.3   -79.61
514770 [MARLNDT4    138.00] AMP    10967.6   -76.88
514778 [CLEOCOR4    138.00] AMP     6420.2   -77.91
515371 [HELENAT2    69.000] AMP     3095.3   -67.77
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515501 [KREMLNT2    69.000] AMP     4913.9   -70.10
515541 [COWBOYH4    138.00] AMP     7457.2   -74.76
515553 [CLEO PL4    138.00] AMP     5386.2   -78.21
520882 [DOVERSW4    138.00] AMP     7456.8   -78.37
521006 [MARSHAL4    138.00] AMP     7764.7   -80.47
560055 [G15-063T    345.00] AMP    17188.7   -84.94
560077 [G16-032-TAP 345.00] AMP     3373.3   -79.62
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
584170 [GEN-2014-064138.00] AMP     9477.5   -82.36
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GEN-2015-063 Short Circuit Analysis Results

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17SP:
PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:01
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560055 [G15-063T    345.00] AMP    16757.8   -84.89
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
515497 [MATHWSN7    345.00] AMP    27519.2   -85.77
585010 [GEN-2015-063345.00] AMP    16485.7   -84.83
514714 [WOODRNG4    138.00] AMP    18630.9   -83.29
514880 [NORTWST7    345.00] AMP    29354.6   -86.04
514901 [CIMARON7    345.00] AMP    29712.0   -85.76
515407 [TATONGA7    345.00] AMP    10482.3   -86.78
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
514708 [OTTER  4    138.00] AMP     9520.8   -82.41
514709 [FRMNTAP4    138.00] AMP    17455.5   -82.87
514711 [WAUKOTP4    138.00] AMP    14930.9   -81.71
514733 [MARSHL 4    138.00] AMP     7784.1   -80.53
514801 [MINCO  7    345.00] AMP    16166.3   -85.15
514803 [SOONER 7    345.00] AMP    24626.1   -86.49
514879 [NORTWST4    138.00] AMP    42442.1   -85.92
514881 [SPRNGCK7    345.00] AMP    21411.7   -85.53
514898 [CIMARON4    138.00] AMP    42021.4   -84.99
514908 [ARCADIA7    345.00] AMP    24883.9   -86.46
514934 [DRAPER 7    345.00] AMP    20389.5   -85.14
515448 [CRSRDSW7    345.00] AMP     8151.4   -85.99
515477 [CHSHLMV7    345.00] AMP    12066.1   -84.69
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
515582 [SLNGWND7    345.00] AMP     7041.8   -85.75
515585 [MAMTHPW7    345.00] AMP     9281.6   -86.61
515610 [FSHRTAP7    345.00] AMP    15917.8   -85.09
562075 [G15-081-TAP 345.00] AMP    11375.5   -86.55
584700 [GEN-2015-029345.00] AMP     7355.2   -85.26
511425 [TUTCONT4    138.00] AMP    10456.4   -80.80
514710 [WAUKOMI4    138.00] AMP     9516.0   -80.46
514712 [FAIRMON4    138.00] AMP    13634.2   -82.23
514713 [WRVALLY4    138.00] AMP     8658.7   -82.14
514731 [SO4TH  4    138.00] AMP    14806.9   -81.22
514802 [SOONER 4    138.00] AMP    31411.9   -86.77
514819 [EL-RENO4    138.00] AMP    15218.5   -80.01
514820 [JENSENT4    138.00] AMP    14995.6   -79.44
514828 [KETCHTP4    138.00] AMP    26013.7   -84.55
514854 [BRADEN 4    138.00] AMP    30755.0   -85.14
514863 [HAYMAKR4    138.00] AMP    26007.0   -82.45
514873 [LNEOAK 4    138.00] AMP    26423.7   -84.56
514894 [CZECHAL4    138.00] AMP    28013.5   -82.98
514895 [SARA   4    138.00] AMP    18582.2   -84.09
514907 [ARCADIA4    138.00] AMP    40842.6   -85.63
514909 [REDBUD 7    345.00] AMP    23853.8   -86.78
514933 [DRAPER 4    138.00] AMP    38576.3   -85.17
515045 [SEMINOL7    345.00] AMP    25941.6   -86.18
515375 [WWRDEHV7    345.00] AMP    16731.1   -86.05
515444 [MCNOWND7    345.00] AMP    16121.2   -85.14
515471 [NW164TH4    138.00] AMP    34845.0   -85.66
515544 [RENFROW4    138.00] AMP    13395.3   -84.84
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515549 [MNCWND37    345.00] AMP    11273.6   -84.89
515576 [RANCHRD7    345.00] AMP    13873.1   -86.68
515600 [KNGFSHR7    345.00] AMP    11007.1   -84.89
515605 [CANADN7     345.00] AMP    11348.5   -84.82
515800 [GRACMNT7    345.00] AMP    14766.5   -85.23
521006 [MARSHAL4    138.00] AMP     7747.8   -80.47
532798 [VIOLA   7   345.00] AMP    11406.1   -85.09
560056 [G15-066T    345.00] AMP    17997.4   -86.55
560077 [G16-032-TAP 345.00] AMP     3367.1   -79.62
579272 [G0744&1403HV345.00] AMP     7041.8   -85.75
583750 [GEN-2013-029345.00] AMP     9999.0   -84.60
584170 [GEN-2014-064138.00] AMP     9448.7   -82.38
584690 [GEN-2015-030345.00] AMP    18751.0   -85.92
584880 [GEN-2015-047345.00] AMP    11012.1   -83.66
585180 [GEN-2015-081345.00] AMP    10013.1   -86.19
509782 [R.S.S.-7    345.00] AMP    30823.7   -86.91
510907 [PITTSB-7    345.00] AMP    13067.7   -84.54
511424 [T-CONCO4    138.00] AMP     6824.2   -74.78
511468 [L.E.S.-7    345.00] AMP    12027.4   -84.69
511501 [TUTTLE4     138.00] AMP    10332.5   -80.76
512694 [CLEVLND7    345.00] AMP    14858.5   -86.35
514704 [MILLERT4    138.00] AMP    20178.4   -85.57
514706 [COWCRK 4    138.00] AMP    11245.6   -82.98
514707 [PERRY  4    138.00] AMP    10947.5   -83.28
514730 [SO4TH  2    69.000] AMP    13548.5   -82.36
514774 [HENESEY4    138.00] AMP     7312.2   -79.09
514790 [IMO    4    138.00] AMP    11621.3   -80.85
514798 [SNRPMPT4    138.00] AMP    20201.9   -85.53
514815 [BRECKNR4    138.00] AMP    13481.0   -80.99
514818 [ELRENO 2    69.000] AMP     7202.2   -78.40
514821 [JENSEN 4    138.00] AMP    10527.7   -79.40
514823 [ROMNOSE4    138.00] AMP     4121.0   -74.29
514827 [CTNWOOD4    138.00] AMP    16556.1   -80.43
514834 [KETCH  4    138.00] AMP    26479.2   -84.56
514851 [QUAILCK4    138.00] AMP    28916.6   -83.27
514852 [SLVRLAK4    138.00] AMP    32141.2   -83.89
514853 [DVISION4    138.00] AMP    35475.8   -83.30
514864 [PIEDMNT4    138.00] AMP    22045.6   -84.44
514893 [XEROX  4    138.00] AMP    29368.7   -82.99
514906 [JNSKAMO4    138.00] AMP    20536.4   -81.91
514946 [MIDWEST4    138.00] AMP    29740.6   -83.52
514949 [SOONRTP4    138.00] AMP    20104.9   -82.40
514961 [GM     4    138.00] AMP    19119.4   -84.12
515003 [BARNES 4    138.00] AMP    15819.6   -83.17
515044 [SEMINOL4    138.00] AMP    39196.8   -85.70
515224 [MUSKOGE7    345.00] AMP    28789.9   -86.76
515376 [WWRDEHV4    138.00] AMP    22228.7   -86.07
515447 [MORISNT4    138.00] AMP    13669.6   -82.93
515458 [BORDER     7345.00] AMP     4957.4   -86.22
515461 [RNDBARN4    138.00] AMP    38851.6   -85.56
515465 [LGARBER4    138.00] AMP    21023.9   -82.40
515466 [MITCHSB4    138.00] AMP    21067.1   -83.35
515481 [STHLAKE4    138.00] AMP    20609.0   -84.63
515546 [GRANTCO4    138.00] AMP     6232.3   -81.17
515569 [MDFRDTP4    138.00] AMP    10855.6   -83.45
515599 [G07621119-20345.00] AMP    11914.2   -85.61
515621 [OPENSKY7    345.00] AMP    12828.8   -86.64
515641 [PLNSMEN4    138.00] AMP    13493.0   -82.03
515802 [GRACMNT4    138.00] AMP    25655.3   -84.71
520409 [RENFROW4    138.00] AMP     9943.2   -83.13
521100 [WARREN 4    138.00] AMP     8658.7   -82.14
529200 [OMCDLEC7    345.00] AMP    13847.3   -86.67
532792 [FR2EAST7    345.00] AMP     6213.4   -85.59
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
539801 [THISTLE7    345.00] AMP    15217.3   -85.86
560071 [G16-003-TAP 345.00] AMP    13436.1   -86.21
560078 [G16-037-TAP 345.00] AMP     6658.5   -84.68
584060 [GEN-2014-056345.00] AMP     8330.2   -84.94
584450 [G1501-G1631 345.00] AMP    11137.1   -85.62
584770 [GEN-2015-034345.00] AMP    11812.8   -86.26
585040 [GEN-2015-066345.00] AMP    17832.1   -86.52
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585270 [GEN-2015-093345.00] AMP     9040.0   -84.98
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:54
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560055 [G15-063T    345.00] AMP    17188.7   -84.94
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
515497 [MATHWSN7    345.00] AMP    29657.1   -86.07
585010 [GEN-2015-063345.00] AMP    16901.5   -84.88
514714 [WOODRNG4    138.00] AMP    18755.9   -83.28
514880 [NORTWST7    345.00] AMP    30523.4   -86.08
514901 [CIMARON7    345.00] AMP    31112.9   -85.94
515407 [TATONGA7    345.00] AMP    15928.8   -86.55
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
514708 [OTTER  4    138.00] AMP     9550.1   -82.39
514709 [FRMNTAP4    138.00] AMP    17566.5   -82.86
514711 [WAUKOTP4    138.00] AMP    15017.2   -81.71
514733 [MARSHL 4    138.00] AMP     7801.1   -80.52
514801 [MINCO  7    345.00] AMP    16528.1   -85.20
514803 [SOONER 7    345.00] AMP    24819.4   -86.49
514879 [NORTWST4    138.00] AMP    42925.0   -85.97
514881 [SPRNGCK7    345.00] AMP    21906.6   -85.52
514898 [CIMARON4    138.00] AMP    42376.5   -85.06
514908 [ARCADIA7    345.00] AMP    26069.9   -86.55
514934 [DRAPER 7    345.00] AMP    20544.1   -85.12
515448 [CRSRDSW7    345.00] AMP    11102.8   -85.54
515477 [CHSHLMV7    345.00] AMP    12423.3   -84.73
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
515582 [SLNGWND7    345.00] AMP     8983.5   -85.26
515585 [MAMTHPW7    345.00] AMP    13253.8   -86.34
515610 [FSHRTAP7    345.00] AMP    16266.6   -85.14
562075 [G15-081-TAP 345.00] AMP    16229.8   -86.40
584700 [GEN-2015-029345.00] AMP     9603.1   -84.60
511425 [TUTCONT4    138.00] AMP    10525.1   -80.78
514710 [WAUKOMI4    138.00] AMP     9564.7   -80.48
514712 [FAIRMON4    138.00] AMP    13706.2   -82.21
514713 [WRVALLY4    138.00] AMP     8694.6   -82.12
514731 [SO4TH  4    138.00] AMP    14888.2   -81.20
514802 [SOONER 4    138.00] AMP    31906.3   -86.80
514819 [EL-RENO4    138.00] AMP    15282.6   -80.04
514820 [JENSENT4    138.00] AMP    15059.3   -79.45
514828 [KETCHTP4    138.00] AMP    26063.9   -84.56
514854 [BRADEN 4    138.00] AMP    30928.2   -85.16
514863 [HAYMAKR4    138.00] AMP    26063.0   -82.47
514873 [LNEOAK 4    138.00] AMP    26553.9   -84.59
514894 [CZECHAL4    138.00] AMP    27689.8   -83.00
514895 [SARA   4    138.00] AMP    18615.0   -84.10
514907 [ARCADIA4    138.00] AMP    41271.5   -85.71
514909 [REDBUD 7    345.00] AMP    25389.3   -86.83
514933 [DRAPER 4    138.00] AMP    38625.6   -85.15
515045 [SEMINOL7    345.00] AMP    26110.6   -86.15
515375 [WWRDEHV7    345.00] AMP    19024.8   -86.11
515444 [MCNOWND7    345.00] AMP    16481.0   -85.19
515471 [NW164TH4    138.00] AMP    35153.6   -85.69
515544 [RENFROW4    138.00] AMP    13620.0   -84.90
515549 [MNCWND37    345.00] AMP    11439.8   -84.91
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515576 [RANCHRD7    345.00] AMP    13911.7   -86.68
515600 [KNGFSHR7    345.00] AMP    11158.5   -84.92
515605 [CANADN7     345.00] AMP    11520.0   -84.86
515800 [GRACMNT7    345.00] AMP    15201.3   -85.32
521006 [MARSHAL4    138.00] AMP     7764.7   -80.47
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
560056 [G15-066T    345.00] AMP    18088.8   -86.54
560077 [G16-032-TAP 345.00] AMP     3373.3   -79.62
579272 [G0744&1403HV345.00] AMP     8983.5   -85.26
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
584170 [GEN-2014-064138.00] AMP     9477.5   -82.36
584690 [GEN-2015-030345.00] AMP    18861.8   -85.91
584880 [GEN-2015-047345.00] AMP    11045.5   -83.64
585180 [GEN-2015-081345.00] AMP    13490.6   -85.91
509782 [R.S.S.-7    345.00] AMP    31506.4   -86.98
510907 [PITTSB-7    345.00] AMP    13104.8   -84.54
511424 [T-CONCO4    138.00] AMP     6853.0   -74.74
511468 [L.E.S.-7    345.00] AMP    12297.1   -84.69
511501 [TUTTLE4     138.00] AMP    10404.6   -80.73
512694 [CLEVLND7    345.00] AMP    14920.4   -86.34
514704 [MILLERT4    138.00] AMP    20472.7   -85.60
514706 [COWCRK 4    138.00] AMP    11321.7   -82.96
514707 [PERRY  4    138.00] AMP    11017.4   -83.26
514730 [SO4TH  2    69.000] AMP    13582.3   -82.36
514774 [HENESEY4    138.00] AMP     7368.8   -79.16
514790 [IMO    4    138.00] AMP    11667.5   -80.83
514798 [SNRPMPT4    138.00] AMP    20526.7   -85.58
514815 [BRECKNR4    138.00] AMP    13554.7   -80.96
514818 [ELRENO 2    69.000] AMP     7312.7   -78.44
514821 [JENSEN 4    138.00] AMP    10567.0   -79.39
514823 [ROMNOSE4    138.00] AMP     4123.2   -74.29
514827 [CTNWOOD4    138.00] AMP    16608.1   -80.43
514834 [KETCH  4    138.00] AMP    26522.7   -84.56
514851 [QUAILCK4    138.00] AMP    28977.6   -83.27
514852 [SLVRLAK4    138.00] AMP    32243.4   -83.91
514853 [DVISION4    138.00] AMP    35480.9   -83.32
514864 [PIEDMNT4    138.00] AMP    22137.3   -84.46
514893 [XEROX  4    138.00] AMP    28887.6   -82.99
514906 [JNSKAMO4    138.00] AMP    20328.0   -81.87
514946 [MIDWEST4    138.00] AMP    29794.8   -83.49
514949 [SOONRTP4    138.00] AMP    20119.5   -82.37
514961 [GM     4    138.00] AMP    19055.3   -84.10
515003 [BARNES 4    138.00] AMP    15720.5   -83.16
515044 [SEMINOL4    138.00] AMP    39329.5   -85.67
515224 [MUSKOGE7    345.00] AMP    28898.4   -86.76
515376 [WWRDEHV4    138.00] AMP    23253.0   -86.23
515447 [MORISNT4    138.00] AMP    13886.8   -82.89
515458 [BORDER     7345.00] AMP     5079.0   -86.22
515461 [RNDBARN4    138.00] AMP    39231.1   -85.63
515465 [LGARBER4    138.00] AMP    20999.6   -82.39
515466 [MITCHSB4    138.00] AMP    21103.6   -83.35
515481 [STHLAKE4    138.00] AMP    20608.9   -84.62
515546 [GRANTCO4    138.00] AMP     6278.4   -81.16
515569 [MDFRDTP4    138.00] AMP    10996.3   -83.46
515599 [G07621119-20345.00] AMP    12892.5   -85.58
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
515641 [PLNSMEN4    138.00] AMP    13564.2   -82.01
515802 [GRACMNT4    138.00] AMP    27934.5   -84.83
520409 [RENFROW4    138.00] AMP    10055.9   -83.15
521100 [WARREN 4    138.00] AMP     8694.6   -82.12
529200 [OMCDLEC7    345.00] AMP    13885.7   -86.67
532792 [FR2EAST7    345.00] AMP     6648.7   -85.72
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
533075 [VIOLA  4    138.00] AMP    22048.6   -86.03
539801 [THISTLE7    345.00] AMP    15582.5   -85.88
560071 [G16-003-TAP 345.00] AMP    14429.6   -86.25
560078 [G16-037-TAP 345.00] AMP     6725.5   -84.70
584060 [GEN-2014-056345.00] AMP     8416.7   -84.95
584450 [G1501-G1631 345.00] AMP    11161.1   -85.62
584770 [GEN-2015-034345.00] AMP    11840.1   -86.25
585040 [GEN-2015-066345.00] AMP    17921.7   -86.52
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585270 [GEN-2015-093345.00] AMP     9194.6   -85.02
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GEN-2015-066 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:01
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560056 [G15-066T    345.00] AMP    17997.4   -86.55
512694 [CLEVLND7    345.00] AMP    14858.5   -86.35
514803 [SOONER 7    345.00] AMP    24626.1   -86.49
585040 [GEN-2015-066345.00] AMP    17832.1   -86.52
509852 [T.NO.--7    345.00] AMP    23431.8   -86.30
512729 [CLEVLND 4   138.00] AMP    16790.8   -85.48
514802 [SOONER 4    138.00] AMP    31411.9   -86.77
514881 [SPRNGCK7    345.00] AMP    21411.7   -85.53
515576 [RANCHRD7    345.00] AMP    13873.1   -86.68
560084 [G16-061-TAP 345.00] AMP    14720.3   -84.89
584690 [GEN-2015-030345.00] AMP    18751.0   -85.92
584880 [GEN-2015-047345.00] AMP    11012.1   -83.66
300138 [4CLEVLND    138.00] AMP    16793.2   -85.46
509755 [WEKIWA-7    345.00] AMP    18607.3   -86.20
509895 [T.NO.2-4    138.00] AMP    34237.3   -84.98
510406 [N.E.S.-7    345.00] AMP    18726.5   -86.41
512865 [GREC TAP5   345.00] AMP    25569.5   -87.31
514704 [MILLERT4    138.00] AMP    20178.4   -85.57
514707 [PERRY  4    138.00] AMP    10947.5   -83.28
514715 [WOODRNG7    345.00] AMP    16948.5   -84.81
514798 [SNRPMPT4    138.00] AMP    20201.9   -85.53
514880 [NORTWST7    345.00] AMP    29354.6   -86.04
515447 [MORISNT4    138.00] AMP    13669.6   -82.93
515621 [OPENSKY7    345.00] AMP    12828.8   -86.64
529200 [OMCDLEC7    345.00] AMP    13847.3   -86.67
584450 [G1501-G1631 345.00] AMP    11137.1   -85.62
584770 [GEN-2015-034345.00] AMP    11812.8   -86.26
300140 [4SILVCTY    138.00] AMP    15805.4   -82.23
300996 [4JAVINE     138.00] AMP     6534.2   -82.68
301429 [4CLEVLNDXFMR138.00] AMP    16793.2   -85.46
509757 [WEKIWA-4    138.00] AMP    31277.7   -84.88
509807 [ONETA--7    345.00] AMP    29582.0   -86.67
509817 [T.NO.--4    138.00] AMP    34296.1   -84.89
509870 [SAPLPRD7    345.00] AMP    21085.5   -86.50
510380 [DELWARE7    345.00] AMP    11399.5   -84.84
512650 [GRDA1  7    345.00] AMP    26001.9   -87.32
512749 [PAWNSW4     138.00] AMP    10200.9   -83.76
514706 [COWCRK 4    138.00] AMP    11245.6   -82.98
514714 [WOODRNG4    138.00] AMP    18630.9   -83.29
514737 [OTOE   4    138.00] AMP    16121.8   -83.27
514743 [OSAGE  4    138.00] AMP    15713.3   -81.70
514799 [SNRPMP 4    138.00] AMP    11194.4   -80.55
514825 [KAYWIND7    345.00] AMP    12795.3   -86.64
514879 [NORTWST4    138.00] AMP    42442.1   -85.92
514901 [CIMARON7    345.00] AMP    29712.0   -85.76
514908 [ARCADIA7    345.00] AMP    24883.9   -86.46
515006 [MORRISN4    138.00] AMP    13639.4   -82.92
515011 [STILWTR4    138.00] AMP    13319.6   -80.16
515412 [DMNCRKT4    138.00] AMP    13499.8   -84.32
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515497 [MATHWSN7    345.00] AMP    27519.2   -85.77
560053 [G15-052T    345.00] AMP    13151.1   -86.46
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560055 [G15-063T    345.00] AMP    16757.8   -84.89
300131 [4FISHERTP   138.00] AMP    14516.3   -80.87
300137 [4BRISTOW    138.00] AMP     7118.1   -79.76
300139 [4FAIRFAX    138.00] AMP     7998.9   -82.27
300141 [4STILWTR    138.00] AMP    13651.2   -81.36
300740 [7SPORTSMAN  345.00] AMP    23557.5   -87.04
300943 [2SILVCTY    69.000] AMP    10100.3   -79.23
301339 [4SFORKKTP   138.00] AMP     6823.0   -82.74
301425 [4GLENCOE    138.00] AMP    10124.8   -82.91
301430 [2CLEVLNDXFMR69.000] AMP    10320.3   -83.69
505610 [KEYSTON4    138.00] AMP    21367.4   -81.37
509745 [CLARKSV7    345.00] AMP    20148.3   -85.89
509782 [R.S.S.-7    345.00] AMP    30823.7   -86.91
509806 [ONETA--4    138.00] AMP    49771.8   -86.49
509812 [SHEFFD-4    138.00] AMP    25256.5   -83.30
509823 [WED-TAP4    138.00] AMP    18893.7   -82.16
509836 [OEC    7    345.00] AMP    29325.3   -86.69
509837 [46ST--E4    138.00] AMP    14018.4   -78.41
509839 [CDC-ET 4    138.00] AMP    18516.4   -79.90
509842 [CDC-WT 4    138.00] AMP    19244.2   -84.19
509844 [OWASOTP4    138.00] AMP    14904.4   -79.83
509851 [P&P WTP4    138.00] AMP    14918.4   -82.10
509863 [PPTAP  4    138.00] AMP    10284.8   -83.76
509871 [SAPLPRD4    138.00] AMP    32031.0   -85.00
509884 [SKIATOK4    138.00] AMP    10413.9   -81.35
510376 [WEBBTAP4    138.00] AMP     8154.9   -79.09
510379 [DELWARE4    138.00] AMP    10821.6   -86.67
510396 [N.E.S.-4    138.00] AMP    35433.4   -85.00
512656 [GRDA1  5    161.00] AMP    41939.4   -86.25
512726 [SILVCTYGR4  138.00] AMP    15649.4   -82.33
512750 [TONECE7     345.00] AMP    14449.7   -86.29
514705 [COWCRK 2    69.000] AMP     4044.1   -86.74
514708 [OTTER  4    138.00] AMP     9520.8   -82.41
514709 [FRMNTAP4    138.00] AMP    17455.5   -82.87
514711 [WAUKOTP4    138.00] AMP    14930.9   -81.71
514713 [WRVALLY4    138.00] AMP     8658.7   -82.14
514733 [MARSHL 4    138.00] AMP     7784.1   -80.53
514742 [OSGE   2    69.000] AMP    14683.5   -84.40
514758 [STDBEAR4    138.00] AMP    13287.0   -81.64
514761 [WHEAGLE4    138.00] AMP    14989.8   -81.76
514770 [MARLNDT4    138.00] AMP    10590.1   -76.91
514801 [MINCO  7    345.00] AMP    16166.3   -85.15
514828 [KETCHTP4    138.00] AMP    26013.7   -84.55
514854 [BRADEN 4    138.00] AMP    30755.0   -85.14
514873 [LNEOAK 4    138.00] AMP    26423.7   -84.56
514898 [CIMARON4    138.00] AMP    42021.4   -84.99
514907 [ARCADIA4    138.00] AMP    40842.6   -85.63
514909 [REDBUD 7    345.00] AMP    23853.8   -86.78
514934 [DRAPER 7    345.00] AMP    20389.5   -85.14
515045 [SEMINOL7    345.00] AMP    25941.6   -86.18
515181 [UNVRSTY4    138.00] AMP    13444.6   -79.90
515400 [DMANCRK4    138.00] AMP     7972.7   -80.19
515407 [TATONGA7    345.00] AMP    10482.3   -86.78
515471 [NW164TH4    138.00] AMP    34845.0   -85.66
515477 [CHSHLMV7    345.00] AMP    12066.1   -84.69
515512 [SPVALLY4    138.00] AMP     8677.6   -77.82
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
515610 [FSHRTAP7    345.00] AMP    15917.8   -85.09
532793 [NEOSHO 7    345.00] AMP    16212.3   -84.49
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
560389 [GEN-2010-055138.00] AMP    31277.7   -84.88
584900 [GEN-2015-052345.00] AMP    13100.6   -86.43
585010 [GEN-2015-063345.00] AMP    16485.7   -84.83
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:55
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560056 [G15-066T    345.00] AMP    18088.8   -86.54
512694 [CLEVLND7    345.00] AMP    14920.4   -86.34
514803 [SOONER 7    345.00] AMP    24819.4   -86.49
585040 [GEN-2015-066345.00] AMP    17921.7   -86.52
509852 [T.NO.--7    345.00] AMP    23628.4   -86.30
512729 [CLEVLND 4   138.00] AMP    16838.3   -85.48
514802 [SOONER 4    138.00] AMP    31906.3   -86.80
514881 [SPRNGCK7    345.00] AMP    21906.6   -85.52
515576 [RANCHRD7    345.00] AMP    13911.7   -86.68
560084 [G16-061-TAP 345.00] AMP    14872.0   -84.89
584690 [GEN-2015-030345.00] AMP    18861.8   -85.91
584880 [GEN-2015-047345.00] AMP    11045.5   -83.64
300138 [4CLEVLND    138.00] AMP    16840.8   -85.46
509755 [WEKIWA-7    345.00] AMP    18794.5   -86.22
509895 [T.NO.2-4    138.00] AMP    34421.2   -84.97
510406 [N.E.S.-7    345.00] AMP    18851.5   -86.42
512865 [GREC TAP5   345.00] AMP    25892.4   -87.33
514704 [MILLERT4    138.00] AMP    20472.7   -85.60
514707 [PERRY  4    138.00] AMP    11017.4   -83.26
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
514798 [SNRPMPT4    138.00] AMP    20526.7   -85.58
514880 [NORTWST7    345.00] AMP    30523.4   -86.08
515447 [MORISNT4    138.00] AMP    13886.8   -82.89
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
529200 [OMCDLEC7    345.00] AMP    13885.7   -86.67
584450 [G1501-G1631 345.00] AMP    11161.1   -85.62
584770 [GEN-2015-034345.00] AMP    11840.1   -86.25
300140 [4SILVCTY    138.00] AMP    15887.3   -82.25
300996 [4JAVINE     138.00] AMP     6541.0   -82.68
301429 [4CLEVLNDXFMR138.00] AMP    16840.8   -85.46
509757 [WEKIWA-4    138.00] AMP    31532.2   -84.88
509807 [ONETA--7    345.00] AMP    29977.3   -86.69
509817 [T.NO.--4    138.00] AMP    34481.1   -84.88
509870 [SAPLPRD7    345.00] AMP    21389.3   -86.54
510380 [DELWARE7    345.00] AMP    11497.3   -84.87
512650 [GRDA1  7    345.00] AMP    26341.5   -87.33
512749 [PAWNSW4     138.00] AMP    10231.7   -83.77
514706 [COWCRK 4    138.00] AMP    11321.7   -82.96
514714 [WOODRNG4    138.00] AMP    18755.9   -83.28
514737 [OTOE   4    138.00] AMP    16309.3   -83.27
514743 [OSAGE  4    138.00] AMP    16704.4   -81.98
514799 [SNRPMP 4    138.00] AMP    11293.5   -80.54
514825 [KAYWIND7    345.00] AMP    12832.5   -86.64
514879 [NORTWST4    138.00] AMP    42925.0   -85.97
514901 [CIMARON7    345.00] AMP    31112.9   -85.94
514908 [ARCADIA7    345.00] AMP    26069.9   -86.55
515006 [MORRISN4    138.00] AMP    13855.3   -82.89
515011 [STILWTR4    138.00] AMP    13902.4   -80.02
515412 [DMNCRKT4    138.00] AMP    13761.8   -84.38
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515497 [MATHWSN7    345.00] AMP    29657.1   -86.07
560053 [G15-052T    345.00] AMP    13222.6   -86.46
560055 [G15-063T    345.00] AMP    17188.7   -84.94
300131 [4FISHERTP   138.00] AMP    14573.4   -80.87
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300137 [4BRISTOW    138.00] AMP     7195.9   -79.86
300139 [4FAIRFAX    138.00] AMP     8035.6   -82.27
300141 [4STILWTR    138.00] AMP    13722.2   -81.44
300740 [7SPORTSMAN  345.00] AMP    23813.1   -87.05
300943 [2SILVCTY    69.000] AMP    10117.1   -79.23
301339 [4SFORKKTP   138.00] AMP     6830.4   -82.73
301425 [4GLENCOE    138.00] AMP    10158.8   -82.96
301430 [2CLEVLNDXFMR69.000] AMP    10330.1   -83.69
505610 [KEYSTON4    138.00] AMP    21485.0   -81.36
509745 [CLARKSV7    345.00] AMP    20459.3   -85.93
509782 [R.S.S.-7    345.00] AMP    31506.4   -86.98
509806 [ONETA--4    138.00] AMP    50347.5   -86.49
509812 [SHEFFD-4    138.00] AMP    25489.8   -83.28
509823 [WED-TAP4    138.00] AMP    19014.9   -82.14
509836 [OEC    7    345.00] AMP    29710.1   -86.71
509837 [46ST--E4    138.00] AMP    14049.3   -78.39
509839 [CDC-ET 4    138.00] AMP    18571.2   -79.88
509842 [CDC-WT 4    138.00] AMP    19303.2   -84.19
509844 [OWASOTP4    138.00] AMP    14933.8   -79.82
509851 [P&P WTP4    138.00] AMP    14963.2   -82.10
509863 [PPTAP  4    138.00] AMP    10301.9   -83.76
509871 [SAPLPRD4    138.00] AMP    32517.9   -84.99
509884 [SKIATOK4    138.00] AMP    10440.8   -81.35
510376 [WEBBTAP4    138.00] AMP     8253.5   -79.08
510379 [DELWARE4    138.00] AMP    11037.0   -86.74
510396 [N.E.S.-4    138.00] AMP    35564.8   -84.99
512656 [GRDA1  5    161.00] AMP    42451.0   -86.27
512726 [SILVCTYGR4  138.00] AMP    15729.4   -82.34
512750 [TONECE7     345.00] AMP    15168.5   -86.39
514705 [COWCRK 2    69.000] AMP     4049.0   -86.74
514708 [OTTER  4    138.00] AMP     9550.1   -82.39
514709 [FRMNTAP4    138.00] AMP    17566.5   -82.86
514711 [WAUKOTP4    138.00] AMP    15017.2   -81.71
514713 [WRVALLY4    138.00] AMP     8694.6   -82.12
514733 [MARSHL 4    138.00] AMP     7801.1   -80.52
514742 [OSGE   2    69.000] AMP    17574.7   -84.60
514758 [STDBEAR4    138.00] AMP    13945.6   -81.82
514761 [WHEAGLE4    138.00] AMP    15727.2   -81.86
514770 [MARLNDT4    138.00] AMP    10967.6   -76.88
514801 [MINCO  7    345.00] AMP    16528.1   -85.20
514828 [KETCHTP4    138.00] AMP    26063.9   -84.56
514854 [BRADEN 4    138.00] AMP    30928.2   -85.16
514873 [LNEOAK 4    138.00] AMP    26553.9   -84.59
514898 [CIMARON4    138.00] AMP    42376.5   -85.06
514907 [ARCADIA4    138.00] AMP    41271.5   -85.71
514909 [REDBUD 7    345.00] AMP    25389.3   -86.83
514934 [DRAPER 7    345.00] AMP    20544.1   -85.12
515045 [SEMINOL7    345.00] AMP    26110.6   -86.15
515181 [UNVRSTY4    138.00] AMP    13740.1   -79.82
515400 [DMANCRK4    138.00] AMP     8063.5   -80.18
515407 [TATONGA7    345.00] AMP    15928.8   -86.55
515471 [NW164TH4    138.00] AMP    35153.6   -85.69
515477 [CHSHLMV7    345.00] AMP    12423.3   -84.73
515512 [SPVALLY4    138.00] AMP     8870.7   -77.69
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
515610 [FSHRTAP7    345.00] AMP    16266.6   -85.14
515644 [STLWTR2     69.000] AMP    16292.2   -78.23
532793 [NEOSHO 7    345.00] AMP    16305.9   -84.49
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
560389 [GEN-2010-055138.00] AMP    31532.2   -84.88
584900 [GEN-2015-052345.00] AMP    13171.6   -86.44
585010 [GEN-2015-063345.00] AMP    16901.5   -84.88
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GEN-2015-069 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:02
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
532874 [UNIONRG6    230.00] AMP     8761.5   -83.67
532863 [MORRIS 6    230.00] AMP    13771.7   -85.33
532873 [SUMMIT 6    230.00] AMP    12899.9   -85.20
533359 [UNIONRG3    115.00] AMP     3784.0   -87.74
585070 [GEN-2015-069230.00] AMP     6569.5   -84.48
530592 [SMOKYHL6    230.00] AMP     6878.9   -84.32
532770 [MORRIS 7    345.00] AMP    12723.9   -85.54
532773 [SUMMIT 7    345.00] AMP    10227.0   -85.73
532856 [SWISVAL6    230.00] AMP    21574.8   -85.43
532862 [MCDOWEL6    230.00] AMP     6891.1   -84.87
532872 [EMCPHER6    230.00] AMP     7712.8   -83.43
533305 [MORRIS 3    115.00] AMP    12403.7   -86.31
533360 [TCHOPE 3    115.00] AMP     3364.2   -87.26
533381 [SUMMIT 3    115.00] AMP    16804.0   -86.27
530558 [KNOLL 6     230.00] AMP    10626.6   -84.66
530593 [SMKYP1 6    230.00] AMP     5985.5   -84.17
530599 [SMKYP2 6    230.00] AMP     6390.1   -84.26
532766 [JEC N  7    345.00] AMP    23297.3   -87.51
532767 [BLUSTEM7    345.00] AMP     9607.1   -86.22
532768 [EMPEC 7     345.00] AMP    17266.2   -86.19
532771 [RENO   7    345.00] AMP    10664.8   -85.60
532774 [SWISVAL7    345.00] AMP    16356.2   -85.36
532851 [AUBURN 6    230.00] AMP    13427.0   -83.79
532853 [LAWHILL6    230.00] AMP    13534.8   -85.37
532857 [TECHILL6    230.00] AMP    11253.8   -84.32
532871 [CIRCLE 6    230.00] AMP     8517.2   -84.20
533309 [WEMPORI3    115.00] AMP     9768.9   -81.62
533335 [MCDOWEL3    115.00] AMP    17699.0   -85.31
533368 [EXIDE J3    115.00] AMP    11979.2   -84.20
533371 [NORTHVW3    115.00] AMP    11329.4   -85.11
533379 [SO GATE3    115.00] AMP    10375.2   -82.94
533417 [EMCPHER3    115.00] AMP    11137.8   -84.65
539805 [ELMCREEK7   345.00] AMP     5249.8   -85.37
530561 [KNOLL  3    115.00] AMP    11432.3   -84.59
530584 [POSTROCK6   230.00] AMP    10797.1   -84.72
530686 [RICE   6    230.00] AMP     4616.0   -82.91
532765 [HOYT   7    345.00] AMP    15355.9   -85.76
532769 [LANG   7    345.00] AMP    17055.8   -86.18
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
532852 [JEC    6    230.00] AMP    24518.1   -87.76
532854 [LEC U5 6    230.00] AMP    13405.1   -85.27
532855 [MIDLAND6    230.00] AMP    12070.5   -84.96
533151 [AUBURN 3    115.00] AMP    21700.1   -84.04
533182 [TECHILE3    115.00] AMP    30009.1   -82.93
533250 [LWRNCHL3    115.00] AMP    26410.6   -83.83
533301 [EAST ST3    115.00] AMP     9201.4   -82.09
533307 [PRAIRIE3    115.00] AMP     9247.4   -82.46
533308 [VAUGHN 3    115.00] AMP     2811.3   -71.29
533311 [WMBROSJ3    115.00] AMP     6760.8   -76.34
533326 [EMANHAT3    115.00] AMP    13086.7   -85.59
533328 [FT JCT 3    115.00] AMP    14502.7   -85.84
533336 [BLUSTEM3    115.00] AMP    16962.0   -86.43
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533341 [STAGGHL3    115.00] AMP    9503.9   -83.82
533350 [SMAN_W_3    115.00] AMP   12503.8   -79.35
533361 [AEC    3    115.00] AMP    7359.8   -85.44
533367 [EXIDE  3    115.00] AMP   10236.0   -81.40
533370 [NORTHST3    115.00] AMP   10173.9   -82.29
533372 [PHILIPS3    115.00] AMP   12011.9   -84.15
533378 [SMOKYHLLS3  115.00] AMP   10775.4   -83.17
533413 [CIRCLE 3    115.00] AMP   18055.7   -85.03
533416 [RENO   3    115.00] AMP   21529.6   -85.57
533426 [MANVILE3    115.00] AMP    8271.4   -82.50
533427 [REFINRY3    115.00] AMP   10290.2   -84.28
539639 [ELMCREK6    230.00] AMP    7276.6   -84.79
539679 [GRTBEND6    230.00] AMP    8074.0   -82.47
542965 [W.GRDNR7    345.00] AMP   25257.1   -85.83
562476 [G14-001-TAP 345.00] AMP   10937.6   -85.04
585100 [GEN-2015-073345.00] AMP   14160.6   -85.65
530551 [SALINE 3    115.00] AMP    4964.3   -78.77
530581 [N HAYS3     115.00] AMP   10001.8   -82.26
530582 [S HAYS6     230.00] AMP    8519.4   -83.65
530583 [POSTROCK7   345.00] AMP    7769.8   -84.75
530605 [REDLIN 3    115.00] AMP    3756.6   -71.72
530623 [RICE   3    115.00] AMP    6740.2   -83.14
530676 [GMEC   3    115.00] AMP   10903.2   -84.54
530677 [OGALATP3    115.00] AMP    2600.8   -78.04
530680 [HEIZER 6    230.00] AMP    8028.8   -82.47
530688 [BUFLOCRK6   230.00] AMP    3537.5   -83.49
532772 [STRANGR7    345.00] AMP   22144.6   -85.94
532791 [BENTON 7    345.00] AMP   19037.9   -85.71
532798 [VIOLA   7   345.00] AMP   11406.1   -85.09
532861 [EMANHAT6    230.00] AMP    9564.4   -85.60
532865 [NMANHT6     230.00] AMP    8769.6   -85.17
532920 [TECHILL5    161.00] AMP    5771.2   -84.76
533040 [EVANS N4    138.00] AMP   37046.2   -87.18
533153 [COLINE 3    115.00] AMP   23231.9   -81.05
533155 [CROOKED3    115.00] AMP   20487.5   -84.00
533163 [HOYT   3    115.00] AMP   22825.2   -85.67
533166 [INDIANH3    115.00] AMP   17631.3   -82.26
533167 [KEENE  3    115.00] AMP   10050.4   -84.37
533176 [SHAWNEE3    115.00] AMP   12204.2   -82.21
533177 [6 GOLDN3    115.00] AMP   16255.5   -81.89
533180 [TEC E  3    115.00] AMP   29596.2   -82.96
533187 [27CROCO3    115.00] AMP   20242.0   -83.02
533194 [SHERWOD3    115.00] AMP   19823.4   -83.74
533197 [HARTLND3    115.00] AMP    4720.0   -74.94
533232 [BALDCRK3    115.00] AMP   14027.8   -83.30
533248 [LEC U3 3    115.00] AMP   25202.6   -83.75
533249 [LEC U4 3    115.00] AMP   24744.6   -83.73
533252 [MIDLAND3    115.00] AMP   25657.0   -83.42
533253 [MOCKBRD3    115.00] AMP   16976.4   -78.43
533264 [6TH ST 3    115.00] AMP   18123.0   -81.65
533270 [STULL T3    115.00] AMP   11952.2   -72.53
533280 [WREN   3    115.00] AMP   13252.1   -80.82
533302 [EEUREKA3    115.00] AMP    1525.2   -69.37
533304 [LANG   3    115.00] AMP   14437.2   -85.16
533310 [WMBROS 3    115.00] AMP    6693.1   -76.24
533327 [LEVEE 3     115.00] AMP   12476.2   -85.40
533330 [JCTCTY 3    115.00] AMP   12375.3   -85.83
533340 [SMANHAT3    115.00] AMP   12503.8   -79.35
533342 [WJCCTY 3    115.00] AMP   13012.3   -85.75
533345 [WILDCAT3    115.00] AMP    9705.8   -84.21
533362 [CHAPMAN3    115.00] AMP   10323.2   -85.53
533365 [EABILEN3    115.00] AMP    7541.9   -85.46
533366 [FLORENC3    115.00] AMP    3213.1   -71.24
533373 [NPHILPJ3    115.00] AMP   11322.7   -84.10
533376 [SALINA 3    115.00] AMP    9749.1   -81.65
533377 [SCHILNG3    115.00] AMP   10224.8   -83.10
533412 [ARKVALJ3    115.00] AMP    9752.9   -83.28
533415 [DAVIS  3    115.00] AMP    8101.2   -82.40
533419 [HEC    3    115.00] AMP   16904.4   -84.92
533421 [HEC GT 3    115.00] AMP   17562.6   -85.04
533422 [HEC U4 3    115.00] AMP   17119.4   -84.70
533428 [MCPHER 3    115.00] AMP   10460.6   -84.18
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533429 [MOUNDRG3    115.00] AMP     7009.8   -83.06
533438 [WMCPHER3    115.00] AMP    10829.6   -84.15
539637 [MRWYP16     230.00] AMP     6642.3   -84.17
539658 [CONCRD6     230.00] AMP     5371.8   -83.05
539678 [GRTBEND3    115.00] AMP    12492.4   -82.48
539695 [SPEARVL6    230.00] AMP    12242.8   -86.28
542966 [WGARDNR5    161.00] AMP    27247.5   -86.91
542968 [STILWEL7    345.00] AMP    24271.7   -85.88
542977 [CRAIG  7    345.00] AMP    21514.6   -85.70
542981 [LACYGNE7    345.00] AMP    24953.9   -86.88
560033 [G1524&G1525T345.00] AMP    19098.2   -86.29
579470 [GEN-2008-092230.00] AMP     7860.0   -84.02
583850 [GEN-2014-001345.00] AMP     7500.6   -84.76
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:55
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
532874 [UNIONRG6    230.00] AMP     8854.7   -83.66
532863 [MORRIS 6    230.00] AMP    13849.2   -85.33
532873 [SUMMIT 6    230.00] AMP    13472.6   -85.34
533359 [UNIONRG3    115.00] AMP     3792.6   -87.75
585070 [GEN-2015-069230.00] AMP     6610.0   -84.48
530592 [SMOKYHL6    230.00] AMP     6936.0   -84.30
532770 [MORRIS 7    345.00] AMP    12789.6   -85.53
532773 [SUMMIT 7    345.00] AMP    10596.8   -85.91
532856 [SWISVAL6    230.00] AMP    21666.7   -85.44
532862 [MCDOWEL6    230.00] AMP     6910.7   -84.93
532872 [EMCPHER6    230.00] AMP     8517.7   -83.90
533305 [MORRIS 3    115.00] AMP    12435.0   -86.31
533360 [TCHOPE 3    115.00] AMP     3371.0   -87.27
533381 [SUMMIT 3    115.00] AMP    17354.8   -86.40
530558 [KNOLL 6     230.00] AMP    10680.7   -84.62
530593 [SMKYP1 6    230.00] AMP     6026.8   -84.15
530599 [SMKYP2 6    230.00] AMP     6437.7   -84.24
532766 [JEC N  7    345.00] AMP    23512.0   -87.51
532767 [BLUSTEM7    345.00] AMP     9735.6   -86.29
532768 [EMPEC 7     345.00] AMP    17379.0   -86.18
532771 [RENO   7    345.00] AMP    11452.3   -85.98
532774 [SWISVAL7    345.00] AMP    16646.6   -85.36
532851 [AUBURN 6    230.00] AMP    13492.6   -83.81
532853 [LAWHILL6    230.00] AMP    14083.6   -85.55
532857 [TECHILL6    230.00] AMP    11294.7   -84.31
532871 [CIRCLE 6    230.00] AMP     9516.1   -84.81
533309 [WEMPORI3    115.00] AMP     9789.0   -81.60
533335 [MCDOWEL3    115.00] AMP    17760.1   -85.57
533368 [EXIDE J3    115.00] AMP    12322.1   -84.29
533371 [NORTHVW3    115.00] AMP    11565.1   -85.16
533379 [SO GATE3    115.00] AMP    10620.4   -82.96
533417 [EMCPHER3    115.00] AMP    12840.7   -85.10
539805 [ELMCREEK7   345.00] AMP     5312.0   -85.44
530561 [KNOLL  3    115.00] AMP    11470.0   -84.54
530584 [POSTROCK6   230.00] AMP    10852.4   -84.69
530686 [RICE   6    230.00] AMP     4803.4   -83.03
532765 [HOYT   7    345.00] AMP    15631.6   -85.78
532769 [LANG   7    345.00] AMP    17165.9   -86.17
532776 [DOUGLAS7    345.00] AMP    18181.4   -85.14
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
532852 [JEC    6    230.00] AMP    24638.7   -87.76
532854 [LEC U5 6    230.00] AMP    13939.6   -85.43
532855 [MIDLAND6    230.00] AMP    12556.5   -85.13
533151 [AUBURN 3    115.00] AMP    21971.2   -84.08
533182 [TECHILE3    115.00] AMP    30490.3   -82.77
533250 [LWRNCHL3    115.00] AMP    29890.1   -83.95
533301 [EAST ST3    115.00] AMP     9216.4   -82.07
533307 [PRAIRIE3    115.00] AMP     9263.3   -82.45
533308 [VAUGHN 3    115.00] AMP     2812.8   -71.28
533311 [WMBROSJ3    115.00] AMP     6773.6   -76.31
533326 [EMANHAT3    115.00] AMP    13121.7   -85.63
533328 [FT JCT 3    115.00] AMP    14583.4   -85.96
533336 [BLUSTEM3    115.00] AMP    17076.8   -86.54
533340 [SMANHAT3    115.00] AMP    11995.0   -85.49
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533341 [STAGGHL3    115.00] AMP     9523.3   -83.88
533361 [AEC    3    115.00] AMP     7412.7   -85.48
533367 [EXIDE  3    115.00] AMP    10485.7   -81.41
533370 [NORTHST3    115.00] AMP    10373.5   -82.31
533372 [PHILIPS3    115.00] AMP    12361.4   -84.25
533378 [SMOKYHLLS3  115.00] AMP    11046.2   -83.21
533413 [CIRCLE 3    115.00] AMP    22707.4   -85.87
533416 [RENO   3    115.00] AMP    25051.7   -86.11
533426 [MANVILE3    115.00] AMP    10205.5   -83.83
533427 [REFINRY3    115.00] AMP    11723.2   -84.78
539639 [ELMCREK6    230.00] AMP     7339.4   -84.83
539679 [GRTBEND6    230.00] AMP     8197.8   -82.43
562476 [G14-001-TAP 345.00] AMP    11039.2   -85.05
585100 [GEN-2015-073345.00] AMP    14235.6   -85.64
530551 [SALINE 3    115.00] AMP     4973.8   -78.74
530581 [N HAYS3     115.00] AMP    10030.0   -82.21
530582 [S HAYS6     230.00] AMP     8566.1   -83.62
530583 [POSTROCK7   345.00] AMP     7799.1   -84.73
530605 [REDLIN 3    115.00] AMP     3776.8   -71.62
530623 [RICE   3    115.00] AMP     6961.3   -83.25
530676 [GMEC   3    115.00] AMP    10936.6   -84.49
530677 [OGALATP3    115.00] AMP     2602.7   -78.02
530680 [HEIZER 6    230.00] AMP     8151.2   -82.43
530688 [BUFLOCRK6   230.00] AMP     3607.1   -83.52
532772 [STRANGR7    345.00] AMP    24258.9   -86.19
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
532861 [EMANHAT6    230.00] AMP     9598.4   -85.63
532865 [NMANHT6     230.00] AMP     8801.0   -85.19
532920 [TECHILL5    161.00] AMP     5790.8   -84.76
533040 [EVANS N4    138.00] AMP    42055.0   -87.26
533153 [COLINE 3    115.00] AMP    23428.9   -80.93
533155 [CROOKED3    115.00] AMP    20729.1   -84.04
533163 [HOYT   3    115.00] AMP    23020.4   -85.75
533166 [INDIANH3    115.00] AMP    17813.8   -82.22
533167 [KEENE  3    115.00] AMP    10030.7   -85.12
533176 [SHAWNEE3    115.00] AMP    12271.8   -82.16
533177 [6 GOLDN3    115.00] AMP    16334.9   -81.83
533180 [TEC E  3    115.00] AMP    30050.9   -82.79
533187 [27CROCO3    115.00] AMP    20482.9   -82.89
533194 [SHERWOD3    115.00] AMP    20132.4   -83.71
533197 [HARTLND3    115.00] AMP    13015.6   -81.23
533232 [BALDCRK3    115.00] AMP    15655.6   -83.78
533248 [LEC U3 3    115.00] AMP    28166.7   -83.82
533249 [LEC U4 3    115.00] AMP    27604.0   -83.79
533252 [MIDLAND3    115.00] AMP    28038.3   -83.33
533253 [MOCKBRD3    115.00] AMP    19820.3   -79.28
533264 [6TH ST 3    115.00] AMP    20340.1   -81.73
533270 [STULL T3    115.00] AMP    12544.6   -72.29
533280 [WREN   3    115.00] AMP    14073.7   -80.69
533285 [DOUGLAS3    115.00] AMP    23725.3   -85.76
533302 [EEUREKA3    115.00] AMP     1525.7   -69.36
533304 [LANG   3    115.00] AMP    14468.0   -85.15
533310 [WMBROS 3    115.00] AMP     6705.7   -76.22
533327 [LEVEE 3     115.00] AMP    12508.2   -85.44
533330 [JCTCTY 3    115.00] AMP    12434.4   -85.93
533339 [S ALMA 3    115.00] AMP     8663.6   -85.36
533342 [WJCCTY 3    115.00] AMP    13081.1   -85.85
533345 [WILDCAT3    115.00] AMP     9726.0   -84.26
533362 [CHAPMAN3    115.00] AMP    10381.0   -85.59
533365 [EABILEN3    115.00] AMP     7591.6   -85.50
533366 [FLORENC3    115.00] AMP     3230.3   -71.18
533373 [NPHILPJ3    115.00] AMP    11627.7   -84.18
533376 [SALINA 3    115.00] AMP     9937.9   -81.66
533377 [SCHILNG3    115.00] AMP    10463.0   -83.15
533412 [ARKVALJ3    115.00] AMP    10847.1   -83.58
533415 [DAVIS  3    115.00] AMP     8740.9   -82.40
533419 [HEC    3    115.00] AMP    22178.8   -85.85
533422 [HEC U4 3    115.00] AMP    21778.6   -85.66
533428 [MCPHER 3    115.00] AMP    11942.4   -84.75
533429 [MOUNDRG3    115.00] AMP     7183.3   -83.13
533438 [WMCPHER3    115.00] AMP    12423.9   -84.78
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539637 [MRWYP16     230.00] AMP     6693.9   -84.21
539658 [CONCRD6     230.00] AMP     5403.6   -83.07
539678 [GRTBEND3    115.00] AMP    12627.1   -82.42
539695 [SPEARVL6    230.00] AMP    12292.5   -86.26
542965 [W.GRDNR7    345.00] AMP    25940.5   -85.83
560033 [G1524&G1525T345.00] AMP    19635.1   -86.39
579470 [GEN-2008-092230.00] AMP     7888.1   -83.99
583850 [GEN-2014-001345.00] AMP     7544.4   -84.77
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GEN-2015-073 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:02
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
532768 [EMPEC 7     345.00] AMP    17266.2   -86.19
532769 [LANG   7    345.00] AMP    17055.8   -86.18
532770 [MORRIS 7    345.00] AMP    12723.9   -85.54
532774 [SWISVAL7    345.00] AMP    16356.2   -85.36
562476 [G14-001-TAP 345.00] AMP    10937.6   -85.04
585100 [GEN-2015-073345.00] AMP    14160.6   -85.65
532766 [JEC N  7    345.00] AMP    23297.3   -87.51
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
532856 [SWISVAL6    230.00] AMP    21574.8   -85.43
532863 [MORRIS 6    230.00] AMP    13771.7   -85.33
533304 [LANG   3    115.00] AMP    14437.2   -85.16
542965 [W.GRDNR7    345.00] AMP    25257.1   -85.83
583850 [GEN-2014-001345.00] AMP     7500.6   -84.76
532765 [HOYT   7    345.00] AMP    15355.9   -85.76
532767 [BLUSTEM7    345.00] AMP     9607.1   -86.22
532771 [RENO   7    345.00] AMP    10664.8   -85.60
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532798 [VIOLA   7   345.00] AMP    11406.1   -85.09
532851 [AUBURN 6    230.00] AMP    13427.0   -83.79
532852 [JEC    6    230.00] AMP    24518.1   -87.76
532853 [LAWHILL6    230.00] AMP    13534.8   -85.37
532857 [TECHILL6    230.00] AMP    11253.8   -84.32
532862 [MCDOWEL6    230.00] AMP     6891.1   -84.87
532874 [UNIONRG6    230.00] AMP     8761.5   -83.67
533040 [EVANS N4    138.00] AMP    37046.2   -87.18
533301 [EAST ST3    115.00] AMP     9201.4   -82.09
533305 [MORRIS 3    115.00] AMP    12403.7   -86.31
533306 [READING3    115.00] AMP     6390.7   -73.71
533307 [PRAIRIE3    115.00] AMP     9247.4   -82.46
542966 [WGARDNR5    161.00] AMP    27247.5   -86.91
542968 [STILWEL7    345.00] AMP    24271.7   -85.88
542977 [CRAIG  7    345.00] AMP    21514.6   -85.70
542981 [LACYGNE7    345.00] AMP    24953.9   -86.88
560033 [G1524&G1525T345.00] AMP    19098.2   -86.29
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
532772 [STRANGR7    345.00] AMP    22144.6   -85.94
532773 [SUMMIT 7    345.00] AMP    10227.0   -85.73
532775 [87TH 7      345.00] AMP    19923.0   -85.69
532792 [FR2EAST7    345.00] AMP     6213.4   -85.59
532793 [NEOSHO 7    345.00] AMP    16212.3   -84.49
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532799 [WAVERLY7    345.00] AMP    14714.1   -86.51
532854 [LEC U5 6    230.00] AMP    13405.1   -85.27
532855 [MIDLAND6    230.00] AMP    12070.5   -84.96
532861 [EMANHAT6    230.00] AMP     9564.4   -85.60
532873 [SUMMIT 6    230.00] AMP    12899.9   -85.20
532986 [BENTON 4    138.00] AMP    27920.3   -85.85
533041 [EVANS S4    138.00] AMP    37046.2   -87.18
533065 [SG12COL4    138.00] AMP    20144.7   -85.76
533151 [AUBURN 3    115.00] AMP    21700.1   -84.04
533163 [HOYT   3    115.00] AMP    22825.2   -85.67
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533171 [OSAGE J3    115.00] AMP     5151.5   -72.86
533182 [TECHILE3    115.00] AMP    30009.1   -82.93
533250 [LWRNCHL3    115.00] AMP    26410.6   -83.83
533309 [WEMPORI3    115.00] AMP     9768.9   -81.62
533335 [MCDOWEL3    115.00] AMP    17699.0   -85.31
533336 [BLUSTEM3    115.00] AMP    16962.0   -86.43
533359 [UNIONRG3    115.00] AMP     3784.0   -87.74
533390 [MAIZEW 4    138.00] AMP    25938.3   -85.53
533416 [RENO   3    115.00] AMP    21529.6   -85.57
539801 [THISTLE7    345.00] AMP    15217.3   -85.86
541198 [PECULR 7    345.00] AMP    20120.4   -85.62
542969 [STILWEL5    161.00] AMP    38995.1   -85.84
542978 [CRAIG  5    161.00] AMP    39244.5   -85.68
543049 [CEDRCRK5    161.00] AMP    27482.3   -84.94
543054 [CEDARNL5    161.00] AMP    13622.2   -84.61
543077 [PLSTVAL5    161.00] AMP     9738.2   -83.35
543105 [BULLCRK5    161.00] AMP    24970.9   -87.10
543132 [BNSF   5    161.00] AMP    19923.4   -85.74
584659 [G15024G15025345.00] AMP     6723.0   -86.50
585070 [GEN-2015-069230.00] AMP     6569.5   -84.48
300739 [7BLACKBERRY 345.00] AMP    12256.2   -84.36
510380 [DELWARE7    345.00] AMP    11399.5   -84.84
515375 [WWRDEHV7    345.00] AMP    16731.1   -86.05
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515544 [RENFROW4    138.00] AMP    13395.3   -84.84
530592 [SMOKYHL6    230.00] AMP     6878.9   -84.32
532780 [CANEYRV7    345.00] AMP     9890.8   -85.50
532795 [FR2WEST7    345.00] AMP     5204.4   -85.65
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
532802 [WAVERTX7    345.00] AMP    12557.2   -86.05
532865 [NMANHT6     230.00] AMP     8769.6   -85.17
532872 [EMCPHER6    230.00] AMP     7712.8   -83.43
532920 [TECHILL5    161.00] AMP     5771.2   -84.76
532937 [NEOSHO 5    161.00] AMP    22018.1   -84.25
532988 [BELAIRE4    138.00] AMP    18644.7   -84.79
532990 [MIDIAN 4    138.00] AMP    10064.0   -80.49
533015 [BENTLEY4    138.00] AMP     9827.0   -85.10
533021 [NEOSHO 4    138.00] AMP    23058.0   -84.46
533024 [29TH   4    138.00] AMP    19407.6   -85.11
533035 [CHISHLM4    138.00] AMP    21792.8   -84.81
533053 [LAKERDG4    138.00] AMP    17998.0   -85.60
533054 [MAIZE  4    138.00] AMP    22203.0   -85.18
533062 [ROSEHIL4    138.00] AMP    31012.2   -86.17
533074 [45TH ST4    138.00] AMP    25948.5   -85.68
533153 [COLINE 3    115.00] AMP    23231.9   -81.05
533155 [CROOKED3    115.00] AMP    20487.5   -84.00
533166 [INDIANH3    115.00] AMP    17631.3   -82.26
533167 [KEENE  3    115.00] AMP    10050.4   -84.37
533169 [NTHLAND3    115.00] AMP    15021.7   -82.70
533170 [OSAGE  3    115.00] AMP     4384.3   -71.72
533176 [SHAWNEE3    115.00] AMP    12204.2   -82.21
533177 [6 GOLDN3    115.00] AMP    16255.5   -81.89
533180 [TEC E  3    115.00] AMP    29596.2   -82.96
533187 [27CROCO3    115.00] AMP    20242.0   -83.02
533194 [SHERWOD3    115.00] AMP    19823.4   -83.74
533197 [HARTLND3    115.00] AMP     4720.0   -74.94
533198 [HOYTJS 3    115.00] AMP    19906.0   -84.88
533199 [HOYTJN 3    115.00] AMP    18914.1   -84.62
533232 [BALDCRK3    115.00] AMP    14027.8   -83.30
533248 [LEC U3 3    115.00] AMP    25202.6   -83.75
533249 [LEC U4 3    115.00] AMP    24744.6   -83.73
533252 [MIDLAND3    115.00] AMP    25657.0   -83.42
533253 [MOCKBRD3    115.00] AMP    16976.4   -78.43
533264 [6TH ST 3    115.00] AMP    18123.0   -81.65
533268 [STRANGR3    115.00] AMP    31874.1   -86.81
533270 [STULL T3    115.00] AMP    11952.2   -72.53
533280 [WREN   3    115.00] AMP    13252.1   -80.82
533283 [87TH 3      115.00] AMP    25986.0   -85.96
533308 [VAUGHN 3    115.00] AMP     2811.3   -71.29
533311 [WMBROSJ3    115.00] AMP     6760.8   -76.34
533326 [EMANHAT3    115.00] AMP    13086.7   -85.59
533328 [FT JCT 3    115.00] AMP    14502.7   -85.84
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533341 [STAGGHL3    115.00] AMP     9503.9   -83.82
533350 [SMAN_W_3    115.00] AMP    12503.8   -79.35
533360 [TCHOPE 3    115.00] AMP     3364.2   -87.26
533362 [CHAPMAN3    115.00] AMP    10323.2   -85.53
533381 [SUMMIT 3    115.00] AMP    16804.0   -86.27
533392 [SCRNTJS3    115.00] AMP     5082.8   -74.25
533413 [CIRCLE 3    115.00] AMP    18055.7   -85.03
533415 [DAVIS  3    115.00] AMP     8101.2   -82.40
533429 [MOUNDRG3    115.00] AMP     7009.8   -83.06
533438 [WMCPHER3    115.00] AMP    10829.6   -84.15
533653 [WOLFCRK2    69.000] AMP     5807.4   -87.18
539804 [THISTLE4    138.00] AMP    16236.4   -86.46
539805 [ELMCREEK7   345.00] AMP     5249.8   -85.37
541200 [PHILL 7     345.00] AMP    18163.2   -85.64
541231 [STRANGR5    161.00] AMP    15158.4   -87.58
541341 [S.HARP 5    161.00] AMP    25058.7   -85.17
541342 [PECULR 5    161.00] AMP    24423.0   -85.47
542979 [PFLUMM 5    161.00] AMP    26864.7   -85.04
542982 [IATAN  7    345.00] AMP    25827.3   -86.70
542994 [HICKMAN5    161.00] AMP    18425.4   -83.90
542995 [MONTROS5    161.00] AMP    17464.0   -84.08
543031 [SHWNMSN5    161.00] AMP    31007.5   -84.73
543038 [LENEXAS5    161.00] AMP    26151.1   -85.03
543039 [LENEXAN5    161.00] AMP    27171.7   -84.72
543044 [MOONLT 5    161.00] AMP    16512.3   -85.05
543048 [COLLEGE5    161.00] AMP    27876.6   -84.69
543050 [ANTIOCH5    161.00] AMP    21950.1   -84.42
543053 [REDEL  5    161.00] AMP    23841.7   -84.19
543055 [SEOTTWA5    161.00] AMP     6692.2   -81.12
543057 [BUCYRUS5    161.00] AMP    19130.2   -84.31
543126 [LACKMAN5    161.00] AMP    13045.2   -83.85
543131 [CLARE  5    161.00] AMP    13982.8   -84.49
560053 [G15-052T    345.00] AMP    13151.1   -86.46
560072 [G16-005-TAP 345.00] AMP    11773.3   -85.29
583750 [GEN-2013-029345.00] AMP     9999.0   -84.60
584660 [GEN-2015-024345.00] AMP     5592.2   -86.53
584670 [GEN-2015-025345.00] AMP     6723.0   -86.50
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:56
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
532768 [EMPEC 7     345.00] AMP    17379.0   -86.18
532769 [LANG   7    345.00] AMP    17165.9   -86.17
532770 [MORRIS 7    345.00] AMP    12789.6   -85.53
532774 [SWISVAL7    345.00] AMP    16646.6   -85.36
562476 [G14-001-TAP 345.00] AMP    11039.2   -85.05
585100 [GEN-2015-073345.00] AMP    14235.6   -85.64
532766 [JEC N  7    345.00] AMP    23512.0   -87.51
532776 [DOUGLAS7    345.00] AMP    18181.4   -85.14
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
532856 [SWISVAL6    230.00] AMP    21666.7   -85.44
532863 [MORRIS 6    230.00] AMP    13849.2   -85.33
533304 [LANG   3    115.00] AMP    14468.0   -85.15
583850 [GEN-2014-001345.00] AMP     7544.4   -84.77
532765 [HOYT   7    345.00] AMP    15631.6   -85.78
532767 [BLUSTEM7    345.00] AMP     9735.6   -86.29
532771 [RENO   7    345.00] AMP    11452.3   -85.98
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
532851 [AUBURN 6    230.00] AMP    13492.6   -83.81
532852 [JEC    6    230.00] AMP    24638.7   -87.76
532853 [LAWHILL6    230.00] AMP    14083.6   -85.55
532857 [TECHILL6    230.00] AMP    11294.7   -84.31
532862 [MCDOWEL6    230.00] AMP     6910.7   -84.93
532874 [UNIONRG6    230.00] AMP     8854.7   -83.66
533040 [EVANS N4    138.00] AMP    42055.0   -87.26
533285 [DOUGLAS3    115.00] AMP    23725.3   -85.76
533301 [EAST ST3    115.00] AMP     9216.4   -82.07
533305 [MORRIS 3    115.00] AMP    12435.0   -86.31
533306 [READING3    115.00] AMP     6395.8   -73.69
533307 [PRAIRIE3    115.00] AMP     9263.3   -82.45
542965 [W.GRDNR7    345.00] AMP    25940.5   -85.83
560033 [G1524&G1525T345.00] AMP    19635.1   -86.39
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
532772 [STRANGR7    345.00] AMP    24258.9   -86.19
532773 [SUMMIT 7    345.00] AMP    10596.8   -85.91
532792 [FR2EAST7    345.00] AMP     6648.7   -85.72
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532854 [LEC U5 6    230.00] AMP    13939.6   -85.43
532855 [MIDLAND6    230.00] AMP    12556.5   -85.13
532861 [EMANHAT6    230.00] AMP     9598.4   -85.63
532873 [SUMMIT 6    230.00] AMP    13472.6   -85.34
532986 [BENTON 4    138.00] AMP    28467.8   -85.82
533041 [EVANS S4    138.00] AMP    42055.0   -87.26
533065 [SG12COL4    138.00] AMP    21501.5   -85.71
533075 [VIOLA  4    138.00] AMP    22048.6   -86.03
533151 [AUBURN 3    115.00] AMP    21971.2   -84.08
533163 [HOYT   3    115.00] AMP    23020.4   -85.75
533171 [OSAGE J3    115.00] AMP     5155.4   -72.85
533182 [TECHILE3    115.00] AMP    30490.3   -82.77
533236 [FAIRGDS3    115.00] AMP    21656.0   -81.51
533250 [LWRNCHL3    115.00] AMP    29890.1   -83.95
533271 [SWLWRNC3    115.00] AMP    21407.1   -81.67
533309 [WEMPORI3    115.00] AMP     9789.0   -81.60
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533335 [MCDOWEL3    115.00] AMP    17760.1   -85.57
533336 [BLUSTEM3    115.00] AMP    17076.8   -86.54
533359 [UNIONRG3    115.00] AMP     3792.6   -87.75
533390 [MAIZEW 4    138.00] AMP    27866.0   -85.44
533416 [RENO   3    115.00] AMP    25051.7   -86.11
539801 [THISTLE7    345.00] AMP    15582.5   -85.88
542966 [WGARDNR5    161.00] AMP    27438.2   -86.93
542968 [STILWEL7    345.00] AMP    24405.9   -85.85
542977 [CRAIG  7    345.00] AMP    21943.2   -85.75
542981 [LACYGNE7    345.00] AMP    25072.0   -86.87
584659 [G15024G15025345.00] AMP     6773.6   -86.53
585070 [GEN-2015-069230.00] AMP     6610.0   -84.48
515375 [WWRDEHV7    345.00] AMP    19024.8   -86.11
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515544 [RENFROW4    138.00] AMP    13620.0   -84.90
530592 [SMOKYHL6    230.00] AMP     6936.0   -84.30
532775 [87TH 7      345.00] AMP    20388.7   -85.75
532793 [NEOSHO 7    345.00] AMP    16305.9   -84.49
532795 [FR2WEST7    345.00] AMP     5480.9   -85.75
532799 [WAVERLY7    345.00] AMP    14765.6   -86.51
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
532865 [NMANHT6     230.00] AMP     8801.0   -85.19
532872 [EMCPHER6    230.00] AMP     8517.7   -83.90
532920 [TECHILL5    161.00] AMP     5790.8   -84.76
532984 [SUMNER 4    138.00] AMP    10235.1   -82.94
532988 [BELAIRE4    138.00] AMP    18912.7   -84.75
532990 [MIDIAN 4    138.00] AMP    10161.1   -80.42
533015 [BENTLEY4    138.00] AMP    10120.0   -85.06
533024 [29TH   4    138.00] AMP    19696.3   -85.08
533035 [CHISHLM4    138.00] AMP    22463.6   -84.76
533036 [CLEARWT4    138.00] AMP    21761.5   -85.40
533046 [GILL S 4    138.00] AMP    28372.2   -85.43
533053 [LAKERDG4    138.00] AMP    18964.1   -85.56
533054 [MAIZE  4    138.00] AMP    23383.8   -85.11
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
533074 [45TH ST4    138.00] AMP    29218.3   -86.41
533153 [COLINE 3    115.00] AMP    23428.9   -80.93
533155 [CROOKED3    115.00] AMP    20729.1   -84.04
533166 [INDIANH3    115.00] AMP    17813.8   -82.22
533167 [KEENE  3    115.00] AMP    10030.7   -85.12
533169 [NTHLAND3    115.00] AMP    15094.8   -82.68
533170 [OSAGE  3    115.00] AMP     4387.2   -71.70
533176 [SHAWNEE3    115.00] AMP    12271.8   -82.16
533177 [6 GOLDN3    115.00] AMP    16334.9   -81.83
533180 [TEC E  3    115.00] AMP    30050.9   -82.79
533187 [27CROCO3    115.00] AMP    20482.9   -82.89
533194 [SHERWOD3    115.00] AMP    20132.4   -83.71
533197 [HARTLND3    115.00] AMP    13015.6   -81.23
533198 [HOYTJS 3    115.00] AMP    20050.1   -84.93
533199 [HOYTJN 3    115.00] AMP    19062.1   -84.73
533232 [BALDCRK3    115.00] AMP    15655.6   -83.78
533234 [BISMARK3    115.00] AMP    21693.3   -80.90
533240 [EUDORA 3    115.00] AMP    12035.4   -81.75
533248 [LEC U3 3    115.00] AMP    28166.7   -83.82
533249 [LEC U4 3    115.00] AMP    27604.0   -83.79
533252 [MIDLAND3    115.00] AMP    28038.3   -83.33
533253 [MOCKBRD3    115.00] AMP    19820.3   -79.28
533256 [19THST 3    115.00] AMP    18580.9   -80.67
533257 [19THSTJ3    115.00] AMP    18988.8   -80.83
533264 [6TH ST 3    115.00] AMP    20340.1   -81.73
533268 [STRANGR3    115.00] AMP    33035.2   -86.94
533270 [STULL T3    115.00] AMP    12544.6   -72.29
533280 [WREN   3    115.00] AMP    14073.7   -80.69
533308 [VAUGHN 3    115.00] AMP     2812.8   -71.28
533311 [WMBROSJ3    115.00] AMP     6773.6   -76.31
533326 [EMANHAT3    115.00] AMP    13121.7   -85.63
533328 [FT JCT 3    115.00] AMP    14583.4   -85.96
533340 [SMANHAT3    115.00] AMP    11995.0   -85.49
533341 [STAGGHL3    115.00] AMP     9523.3   -83.88
533360 [TCHOPE 3    115.00] AMP     3371.0   -87.27
533362 [CHAPMAN3    115.00] AMP    10381.0   -85.59
533381 [SUMMIT 3    115.00] AMP    17354.8   -86.40
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533392 [SCRNTJS3    115.00] AMP     5088.0   -74.23
533413 [CIRCLE 3    115.00] AMP    22707.4   -85.87
533415 [DAVIS  3    115.00] AMP     8740.9   -82.40
533429 [MOUNDRG3    115.00] AMP     7183.3   -83.13
533438 [WMCPHER3    115.00] AMP    12423.9   -84.78
533653 [WOLFCRK2    69.000] AMP     6015.6   -87.23
533880 [GODDARD2    138.00] AMP    18934.8   -85.91
539804 [THISTLE4    138.00] AMP    16466.9   -86.37
539805 [ELMCREEK7   345.00] AMP     5312.0   -85.44
541198 [PECULR 7    345.00] AMP    20157.7   -85.60
542969 [STILWEL5    161.00] AMP    38873.3   -85.82
542978 [CRAIG  5    161.00] AMP    39834.8   -85.73
542982 [IATAN  7    345.00] AMP    27045.8   -86.66
543049 [CEDRCRK5    161.00] AMP    27771.9   -84.96
543054 [CEDARNL5    161.00] AMP    13669.0   -84.61
543077 [PLSTVAL5    161.00] AMP     9761.2   -83.34
543105 [BULLCRK5    161.00] AMP    25121.9   -87.11
543132 [BNSF   5    161.00] AMP    20024.4   -85.74
560053 [G15-052T    345.00] AMP    13222.6   -86.46
560072 [G16-005-TAP 345.00] AMP    11874.9   -85.29
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
584660 [GEN-2015-024345.00] AMP     5625.2   -86.55
584670 [GEN-2015-025345.00] AMP     6773.6   -86.53
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GEN-2015-083 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:02
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
533063 [SC10BEL4    138.00] AMP     8715.4   -81.32
532984 [SUMNER 4    138.00] AMP     7416.1   -82.19
533042 [FARBER 4    138.00] AMP    15552.0   -83.79
585200 [GEN-2015-083138.00] AMP     6375.2   -80.45
532982 [OXFORD 4    138.00] AMP     7065.2   -82.28
532992 [TIMBJCT4    138.00] AMP     4861.9   -82.88
533039 [ELPASO 4    138.00] AMP    24353.8   -84.19
532981 [CRESWLN4    138.00] AMP     7236.6   -81.47
532985 [TCROCK 4    138.00] AMP     4590.1   -82.90
533029 [59TH ST4    138.00] AMP    17279.0   -83.56
533032 [BU11PON4    138.00] AMP    14859.8   -80.39
533062 [ROSEHIL4    138.00] AMP    31012.2   -86.17
533066 [64TH   4    138.00] AMP    14141.5   -82.99
533068 [STEARMN4    138.00] AMP    19364.9   -84.21
533558 [TIMBJCT2    69.000] AMP     7492.3   -83.63
533793 [ELPASO 2    69.000] AMP    11687.8   -83.08
514804 [MIDLTNT4    138.00] AMP     7420.0   -79.57
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
532991 [WEAVER 4    138.00] AMP    21770.4   -83.96
533030 [BOEING 4    138.00] AMP    16809.7   -83.81
533046 [GILL S 4    138.00] AMP    21928.3   -84.55
533048 [HARRY  4    138.00] AMP    13403.8   -82.76
533070 [SLATECRK4   138.00] AMP     4293.9   -81.63
533541 [AKRON  2    69.000] AMP     6269.2   -81.92
533543 [CRESWLN2    69.000] AMP    10055.6   -83.44
533559 [UDALL  2    69.000] AMP     6679.2   -83.67
533561 [WINFLD 2    69.000] AMP     6019.1   -80.72
533821 [MULVANE2    69.000] AMP     5333.0   -78.00
533824 [OAKLAWN2    69.000] AMP    15422.2   -78.54
533842 [64TH   2    69.000] AMP    14570.8   -84.52
515381 [PECKHMT4    138.00] AMP     7989.7   -79.23
521198 [CHILOCCO4   138.00] AMP     5837.6   -77.36
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
532993 [TALLGRS4    138.00] AMP     9974.9   -79.23
533026 [ANDOVER4    138.00] AMP    17621.1   -84.15
533028 [BEECHTP4    138.00] AMP    13423.0   -82.63
533033 [CANAL  4    138.00] AMP    16360.9   -83.95
533045 [GILL W 4    138.00] AMP    21928.3   -84.55
533067 [SPRNGDL4    138.00] AMP    14308.8   -83.06
533547 [OAK    2    69.000] AMP     7247.4   -82.01
533548 [PARIS  2    69.000] AMP     6300.0   -82.17
533549 [RAINBOW2    69.000] AMP     5488.5   -77.69
533550 [RICHLAN2    69.000] AMP     5755.3   -83.94
533551 [SC1KING2    69.000] AMP     3176.3   -63.20
533553 [SC4ROME2    69.000] AMP     5302.4   -83.71
533555 [SC7CRES2    69.000] AMP     9936.9   -83.52
533556 [STROTHR2    69.000] AMP     5686.9   -80.98
533604 [WEAVER 2    69.000] AMP    11614.9   -85.82
533792 [EASTBOR2    69.000] AMP    14448.2   -83.27
533795 [GILL E 2    69.000] AMP    30373.3   -84.89
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533796 [GILL W 2    69.000] AMP    30373.3   -84.89
533808 [HYDRJN2     69.000] AMP    15718.3   -77.61
533826 [OLIVER 2    69.000] AMP    13972.7   -79.25
560053 [G15-052T    345.00] AMP    13151.1   -86.46
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:56
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
533063 [SC10BEL4    138.00] AMP    10219.1   -81.97
532984 [SUMNER 4    138.00] AMP    10235.1   -82.94
533042 [FARBER 4    138.00] AMP    16424.6   -83.72
585200 [GEN-2015-083138.00] AMP     7093.1   -80.69
532982 [OXFORD 4    138.00] AMP     9261.7   -82.99
532992 [TIMBJCT4    138.00] AMP     5701.7   -83.31
533039 [ELPASO 4    138.00] AMP    25627.9   -84.16
533075 [VIOLA  4    138.00] AMP    22048.6   -86.03
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
532981 [CRESWLN4    138.00] AMP     7961.8   -81.85
532985 [TCROCK 4    138.00] AMP     5331.5   -83.31
533029 [59TH ST4    138.00] AMP    18965.7   -83.67
533032 [BU11PON4    138.00] AMP    15179.0   -80.27
533036 [CLEARWT4    138.00] AMP    21761.5   -85.40
533046 [GILL S 4    138.00] AMP    28372.2   -85.43
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
533066 [64TH   4    138.00] AMP    14462.1   -82.99
533068 [STEARMN4    138.00] AMP    19919.5   -84.15
533558 [TIMBJCT2    69.000] AMP     8063.6   -84.01
533793 [ELPASO 2    69.000] AMP    11846.9   -83.18
514804 [MIDLTNT4    138.00] AMP     7819.1   -79.69
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
532792 [FR2EAST7    345.00] AMP     6648.7   -85.72
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
532991 [WEAVER 4    138.00] AMP    22302.1   -83.88
533030 [BOEING 4    138.00] AMP    17232.3   -83.76
533045 [GILL W 4    138.00] AMP    28372.2   -85.43
533048 [HARRY  4    138.00] AMP    13669.9   -82.74
533070 [SLATECRK4   138.00] AMP     4506.3   -81.76
533541 [AKRON  2    69.000] AMP     6665.3   -82.12
533543 [CRESWLN2    69.000] AMP    10673.2   -83.78
533559 [UDALL  2    69.000] AMP     7068.9   -83.95
533561 [WINFLD 2    69.000] AMP     6265.1   -80.82
533795 [GILL E 2    69.000] AMP    33847.5   -85.47
533796 [GILL W 2    69.000] AMP    33847.5   -85.47
533821 [MULVANE2    69.000] AMP     5366.1   -78.01
533824 [OAKLAWN2    69.000] AMP    15709.0   -79.07
533842 [64TH   2    69.000] AMP    14771.2   -84.90
533880 [GODDARD2    138.00] AMP    18934.8   -85.91
539675 [MILANTP4    138.00] AMP     7081.3   -75.28
515381 [PECKHMT4    138.00] AMP     8343.1   -79.24
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515544 [RENFROW4    138.00] AMP    13620.0   -84.90
521198 [CHILOCCO4   138.00] AMP     6082.0   -77.37
532771 [RENO   7    345.00] AMP    11452.3   -85.98
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532795 [FR2WEST7    345.00] AMP     5480.9   -85.75
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
532993 [TALLGRS4    138.00] AMP    10076.3   -79.15
533026 [ANDOVER4    138.00] AMP    17928.3   -84.09
533028 [BEECHTP4    138.00] AMP    13677.4   -82.59
533033 [CANAL  4    138.00] AMP    16780.7   -83.93
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533040 [EVANS N4    138.00] AMP    42055.0   -87.26
533041 [EVANS S4    138.00] AMP    42055.0   -87.26
533044 [GILL E 4    138.00] AMP    28372.2   -85.43
533067 [SPRNGDL4    138.00] AMP    14575.4   -83.01
533072 [WACO   4    138.00] AMP    23426.2   -85.29
533547 [OAK    2    69.000] AMP     7581.3   -82.17
533548 [PARIS  2    69.000] AMP     6542.3   -82.33
533549 [RAINBOW2    69.000] AMP     5686.9   -77.68
533550 [RICHLAN2    69.000] AMP     5900.1   -84.04
533551 [SC1KING2    69.000] AMP     3271.3   -62.73
533553 [SC4ROME2    69.000] AMP     5422.9   -83.82
533555 [SC7CRES2    69.000] AMP    10539.6   -83.86
533556 [STROTHR2    69.000] AMP     5901.8   -81.08
533604 [WEAVER 2    69.000] AMP    11753.1   -85.83
533792 [EASTBOR2    69.000] AMP    14680.2   -84.02
533798 [GILLJCT2    69.000] AMP    21917.8   -81.99
533804 [HAYSVLJ2    69.000] AMP    14285.5   -78.19
533808 [HYDRJN2     69.000] AMP    16113.8   -77.84
533813 [MACARTH2    69.000] AMP    22504.1   -81.15
533826 [OLIVER 2    69.000] AMP    14117.1   -80.59
533830 [PECK   2    69.000] AMP     6600.3   -83.88
533850 [VULCAN 2    69.000] AMP    20523.6   -84.38
533851 [VULCTP 2    69.000] AMP    24543.8   -84.83
539668 [HARPER 4    138.00] AMP     5947.9   -79.19
539676 [MILAN 4     138.00] AMP     4204.1   -73.50
560033 [G1524&G1525T345.00] AMP    19635.1   -86.39
560053 [G15-052T    345.00] AMP    13222.6   -86.46
562476 [G14-001-TAP 345.00] AMP    11039.2   -85.05
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
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GEN-2015-093 Short Circuit Analysis Results

17SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  15:02
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 17S WITH MMWG 15S, MRO 16W TOPO/16S PROF, SERC 16S

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X          /I+/    AN(I+)
560033 [G1524&G1525T345.00] AMP    19098.2   -86.29
532796 [WICHITA7    345.00] AMP    23680.3   -86.10
539801 [THISTLE7    345.00] AMP    15217.3   -85.86
584659 [G15024G15025345.00] AMP     6723.0   -86.50
515375 [WWRDEHV7    345.00] AMP    16731.1   -86.05
532771 [RENO   7    345.00] AMP    10664.8   -85.60
532791 [BENTON 7    345.00] AMP    19037.9   -85.71
532798 [VIOLA   7   345.00] AMP    11406.1   -85.09
533040 [EVANS N4    138.00] AMP    37046.2   -87.18
539804 [THISTLE4    138.00] AMP    16236.4   -86.46
560072 [G16-005-TAP 345.00] AMP    11773.3   -85.29
562476 [G14-001-TAP 345.00] AMP    10937.6   -85.04
584660 [GEN-2015-024345.00] AMP     5592.2   -86.53
584670 [GEN-2015-025345.00] AMP     6723.0   -86.50
515376 [WWRDEHV4    138.00] AMP    22228.7   -86.07
515458 [BORDER     7345.00] AMP     4957.4   -86.22
515543 [RENFROW7    345.00] AMP    11220.0   -84.65
515599 [G07621119-20345.00] AMP    11914.2   -85.61
532768 [EMPEC 7     345.00] AMP    17266.2   -86.19
532773 [SUMMIT 7    345.00] AMP    10227.0   -85.73
532792 [FR2EAST7    345.00] AMP     6213.4   -85.59
532794 [ROSEHIL7    345.00] AMP    18846.1   -85.81
532797 [WOLFCRK7    345.00] AMP    15973.0   -86.81
532986 [BENTON 4    138.00] AMP    27920.3   -85.85
533041 [EVANS S4    138.00] AMP    37046.2   -87.18
533065 [SG12COL4    138.00] AMP    20144.7   -85.76
533390 [MAIZEW 4    138.00] AMP    25938.3   -85.53
533416 [RENO   3    115.00] AMP    21529.6   -85.57
539638 [FLATRDG4    138.00] AMP    14578.0   -85.82
539800 [CLARKCOUNTY7345.00] AMP    12565.1   -84.74
560071 [G16-003-TAP 345.00] AMP    13436.1   -86.21
562075 [G15-081-TAP 345.00] AMP    11375.5   -86.55
583850 [GEN-2014-001345.00] AMP     7500.6   -84.76
585250 [GEN-2015-090345.00] AMP     3174.4   -85.89
514796 [IODINE-4    138.00] AMP     7147.0   -79.88
515394 [KEENAN 4    138.00] AMP     7925.9   -84.90
515398 [OUSPRT 4    138.00] AMP     8696.8   -82.16
515407 [TATONGA7    345.00] AMP    10482.3   -86.78
515476 [HUNTERS7    345.00] AMP    12082.1   -84.69
515544 [RENFROW4    138.00] AMP    13395.3   -84.84
515997 [WWPAR4      138.00] AMP    16462.2   -84.15
525832 [TUCO_INT   7345.00] AMP    10101.9   -85.89
532767 [BLUSTEM7    345.00] AMP     9607.1   -86.22
532769 [LANG   7    345.00] AMP    17055.8   -86.18
532770 [MORRIS 7    345.00] AMP    12723.9   -85.54
532774 [SWISVAL7    345.00] AMP    16356.2   -85.36
532795 [FR2WEST7    345.00] AMP     5204.4   -85.65
532799 [WAVERLY7    345.00] AMP    14714.1   -86.51
532800 [LATHAMS7    345.00] AMP    10464.2   -85.56
532873 [SUMMIT 6    230.00] AMP    12899.9   -85.20
532988 [BELAIRE4    138.00] AMP    18644.7   -84.79
532990 [MIDIAN 4    138.00] AMP    10064.0   -80.49
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533015 [BENTLEY4    138.00] AMP    9827.0   -85.10
533024 [29TH   4    138.00] AMP   19407.6   -85.11
533035 [CHISHLM4    138.00] AMP   21792.8   -84.81
533053 [LAKERDG4    138.00] AMP   17998.0   -85.60
533054 [MAIZE  4    138.00] AMP   22203.0   -85.18
533062 [ROSEHIL4    138.00] AMP   31012.2   -86.17
533074 [45TH ST4    138.00] AMP   25948.5   -85.68
533413 [CIRCLE 3    115.00] AMP   18055.7   -85.03
533415 [DAVIS  3    115.00] AMP    8101.2   -82.40
533429 [MOUNDRG3    115.00] AMP    7009.8   -83.06
533438 [WMCPHER3    115.00] AMP   10829.6   -84.15
533653 [WOLFCRK2    69.000] AMP    5807.4   -87.18
539631 [FLATRWD4    138.00] AMP    9661.7   -83.97
539668 [HARPER 4    138.00] AMP    5658.0   -80.21
539674 [BARBER 4    138.00] AMP    7961.3   -83.81
539805 [ELMCREEK7   345.00] AMP    5249.8   -85.37
560002 [IRONWOOD7   345.00] AMP   12821.9   -85.12
560053 [G15-052T    345.00] AMP   13151.1   -86.46
560070 [G16-001-TAP 345.00] AMP   12547.4   -86.28
560080 [G16-046-TAP 345.00] AMP   10671.8   -78.79
582008 [GEN-2011-008345.00] AMP   10443.4   -84.38
583090 [G1149&G1504 345.00] AMP    4543.3   -86.07
583370 [GEN-2012-024345.00] AMP   10805.4   -84.65
583750 [GEN-2013-029345.00] AMP    9999.0   -84.60
584980 [GEN-2015-060138.00] AMP    5618.6   -86.36
585100 [GEN-2015-073345.00] AMP   14160.6   -85.65
585180 [GEN-2015-081345.00] AMP   10013.1   -86.19
585410 [GREAT_WESTRN345.00] AMP    9253.6   -85.33
585430 [PRSIMN_CRK1 345.00] AMP   10624.4   -85.49
514715 [WOODRNG7    345.00] AMP   16948.5   -84.81
514785 [WOODWRD4    138.00] AMP   12033.9   -80.92
514787 [DEWEY  4    138.00] AMP    7158.9   -77.26
515448 [CRSRDSW7    345.00] AMP    8151.4   -85.99
515477 [CHSHLMV7    345.00] AMP   12066.1   -84.69
515497 [MATHWSN7    345.00] AMP   27519.2   -85.77
515546 [GRANTCO4    138.00] AMP    6232.3   -81.17
515569 [MDFRDTP4    138.00] AMP   10855.6   -83.45
515582 [SLNGWND7    345.00] AMP    7041.8   -85.75
515585 [MAMTHPW7    345.00] AMP    9281.6   -86.61
515621 [OPENSKY7    345.00] AMP   12828.8   -86.64
520409 [RENFROW4    138.00] AMP    9943.2   -83.13
525830 [TUCO_INT   6230.00] AMP   19244.5   -84.53
530592 [SMOKYHL6    230.00] AMP    6878.9   -84.32
531469 [SPERVIL7    345.00] AMP   13211.6   -84.83
532766 [JEC N  7    345.00] AMP   23297.3   -87.51
532780 [CANEYRV7    345.00] AMP    9890.8   -85.50
532801 [ELKRVR17    345.00] AMP    9239.4   -85.46
532802 [WAVERTX7    345.00] AMP   12557.2   -86.05
532856 [SWISVAL6    230.00] AMP   21574.8   -85.43
532863 [MORRIS 6    230.00] AMP   13771.7   -85.33
532871 [CIRCLE 6    230.00] AMP    8517.2   -84.20
532872 [EMCPHER6    230.00] AMP    7712.8   -83.43
532874 [UNIONRG6    230.00] AMP    8761.5   -83.67
532987 [BUTLER 4    138.00] AMP    9877.9   -79.44
532991 [WEAVER 4    138.00] AMP   21770.4   -83.96
533012 [HALSTDS4    138.00] AMP    4213.4   -85.32
533013 [MOUND  4    138.00] AMP    4799.5   -84.74
533016 [WWUPLNT4    138.00] AMP    7582.8   -84.70
533031 [BURNSTP4    138.00] AMP    4470.1   -76.64
533037 [COMOTAR4    138.00] AMP   18402.0   -84.62
533038 [COWSKIN4    138.00] AMP   18335.4   -84.63
533039 [ELPASO 4    138.00] AMP   24353.8   -84.19
533049 [HOOVERN4    138.00] AMP   17652.1   -84.96
533060 [NOEASTE4    138.00] AMP   20291.2   -84.75
533064 [17TH   4    138.00] AMP   17543.0   -84.54
533068 [STEARMN4    138.00] AMP   19364.9   -84.21
533304 [LANG   3    115.00] AMP   14437.2   -85.16
533336 [BLUSTEM3    115.00] AMP   16962.0   -86.43
533372 [PHILIPS3    115.00] AMP   12011.9   -84.15
533380 [SPRGCRK3    115.00] AMP    3589.7   -72.59
533381 [SUMMIT 3    115.00] AMP   16804.0   -86.27
533391 [MAIZEE 4    138.00] AMP   20951.8   -85.00
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533412 [ARKVALJ3    115.00] AMP     9752.9   -83.28
533414 [CITIES 3    115.00] AMP     8101.9   -82.20
533419 [HEC    3    115.00] AMP    16904.4   -84.92
533421 [HEC GT 3    115.00] AMP    17562.6   -85.04
533422 [HEC U4 3    115.00] AMP    17119.4   -84.70
533426 [MANVILE3    115.00] AMP     8271.4   -82.50
533428 [MCPHER 3    115.00] AMP    10460.6   -84.18
533439 [WHEATLD3    115.00] AMP     7301.7   -83.62
533506 [DAVIS  2    69.000] AMP     7232.8   -82.31
533597 [MIDIAN 2    69.000] AMP    12202.5   -81.94
533626 [BURLJCT2    69.000] AMP     4774.0   -85.78
533629 [CC2SHAR2    69.000] AMP     4514.5   -81.43
533786 [CHISHLM2    69.000] AMP    18509.0   -85.40
539001 [ANTHONY4    138.00] AMP     3468.1   -81.60
539639 [ELMCREK6    230.00] AMP     7276.6   -84.79
539675 [MILANTP4    138.00] AMP     6038.6   -77.02
539760 [BARBER 3    115.00] AMP     7843.2   -83.45
539803 [IRONWOOD7   345.00] AMP    12788.2   -84.51
542965 [W.GRDNR7    345.00] AMP    25257.1   -85.83
542981 [LACYGNE7    345.00] AMP    24953.9   -86.88
560000 [G11-14-TAP  345.00] AMP    13007.9   -86.33
560027 [G14-074-TAP 345.00] AMP     6084.4   -85.14
578530 [FR3         345.00] AMP     4839.0   -85.62
582016 [GEN-2011-016345.00] AMP     7279.3   -81.56
582708 [G-2011-008-1345.00] AMP     8823.5   -84.09
584700 [GEN-2015-029345.00] AMP     7355.2   -85.26
584900 [GEN-2015-052345.00] AMP    13100.6   -86.43
585060 [GEN-2015-068345.00] AMP     8507.5   -85.73
585420 [COWBOY_RIDGE345.00] AMP     7271.5   -85.08
585440 [PRSIMN_CRK2 345.00] AMP     9778.2   -85.39
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25SP:

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PSS®E-32.2.0 ASCC SHORT CIRCUIT CURRENTS          FRI, JUL 14 2017  14:56
2015 MDWG FINAL WITH 2013 MMWG, UPDATED WITH 2014 SERC & MRO
MDWG 2025S WITH MMWG 2024S, MRO & SERC 2025 SUMMER

OPTIONS USED:
    - FLAT CONDITIONS
         - BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
         - GENERATOR P=0, Q=0
         - TRANSFOMRER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
         - LINE CHARGING=0.0 IN +/-/0 SEQUENCE
         - LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
         - LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
         - DC LINES AND FACTS DEVICES BLOCKED
         - TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

                                  THREE PHASE FAULT
X---------- BUS ----------X         /I+/    AN(I+)
560033 [G1524&G1525T345.00] AMP    19635.1   -86.39
532796 [WICHITA7    345.00] AMP    24651.6   -86.24
539801 [THISTLE7    345.00] AMP    15582.5   -85.88
584659 [G15024G15025345.00] AMP     6773.6   -86.53
515375 [WWRDEHV7    345.00] AMP    19024.8   -86.11
532771 [RENO   7    345.00] AMP    11452.3   -85.98
532791 [BENTON 7    345.00] AMP    19399.8   -85.74
532798 [VIOLA   7   345.00] AMP    13505.4   -85.45
533040 [EVANS N4    138.00] AMP    42055.0   -87.26
539804 [THISTLE4    138.00] AMP    16466.9   -86.37
560072 [G16-005-TAP 345.00] AMP    11874.9   -85.29
562476 [G14-001-TAP 345.00] AMP    11039.2   -85.05
584660 [GEN-2015-024345.00] AMP     5625.2   -86.55
584670 [GEN-2015-025345.00] AMP     6773.6   -86.53
515376 [WWRDEHV4    138.00] AMP    23253.0   -86.23
515458 [BORDER     7345.00] AMP     5079.0   -86.22
515543 [RENFROW7    345.00] AMP    11852.2   -84.75
515599 [G07621119-20345.00] AMP    12892.5   -85.58
532768 [EMPEC 7     345.00] AMP    17379.0   -86.18
532773 [SUMMIT 7    345.00] AMP    10596.8   -85.91
532792 [FR2EAST7    345.00] AMP     6648.7   -85.72
532794 [ROSEHIL7    345.00] AMP    19147.6   -85.82
532797 [WOLFCRK7    345.00] AMP    16041.1   -86.82
532986 [BENTON 4    138.00] AMP    28467.8   -85.82
533041 [EVANS S4    138.00] AMP    42055.0   -87.26
533065 [SG12COL4    138.00] AMP    21501.5   -85.71
533075 [VIOLA  4    138.00] AMP    22048.6   -86.03
533390 [MAIZEW 4    138.00] AMP    27866.0   -85.44
533416 [RENO   3    115.00] AMP    25051.7   -86.11
539638 [FLATRDG4    138.00] AMP    14789.4   -85.70
539800 [CLARKCOUNTY7345.00] AMP    12653.9   -84.74
560071 [G16-003-TAP 345.00] AMP    14429.6   -86.25
562075 [G15-081-TAP 345.00] AMP    16229.8   -86.40
583850 [GEN-2014-001345.00] AMP     7544.4   -84.77
585250 [GEN-2015-090345.00] AMP     3183.7   -85.89
514796 [IODINE-4    138.00] AMP     7204.0   -79.88
515394 [KEENAN 4    138.00] AMP     8052.5   -84.94
515398 [OUSPRT 4    138.00] AMP     8849.6   -82.16
515407 [TATONGA7    345.00] AMP    15928.8   -86.55
515476 [HUNTERS7    345.00] AMP    12440.3   -84.73
515544 [RENFROW4    138.00] AMP    13620.0   -84.90
515997 [WWPAR4      138.00] AMP    16921.3   -84.21
525832 [TUCO_INT   7345.00] AMP    12298.4   -86.13
532767 [BLUSTEM7    345.00] AMP     9735.6   -86.29
532769 [LANG   7    345.00] AMP    17165.9   -86.17
532770 [MORRIS 7    345.00] AMP    12789.6   -85.53
532774 [SWISVAL7    345.00] AMP    16646.6   -85.36
532795 [FR2WEST7    345.00] AMP     5480.9   -85.75
532799 [WAVERLY7    345.00] AMP    14765.6   -86.51
532800 [LATHAMS7    345.00] AMP    10520.0   -85.56
532873 [SUMMIT 6    230.00] AMP    13472.6   -85.34
532984 [SUMNER 4    138.00] AMP    10235.1   -82.94
532988 [BELAIRE4    138.00] AMP    18912.7   -84.75
532990 [MIDIAN 4    138.00] AMP    10161.1   -80.42
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533015 [BENTLEY4    138.00] AMP    10120.0   -85.06
533024 [29TH   4    138.00] AMP    19696.3   -85.08
533035 [CHISHLM4    138.00] AMP    22463.6   -84.76
533036 [CLEARWT4    138.00] AMP    21761.5   -85.40
533046 [GILL S 4    138.00] AMP    28372.2   -85.43
533053 [LAKERDG4    138.00] AMP    18964.1   -85.56
533054 [MAIZE  4    138.00] AMP    23383.8   -85.11
533062 [ROSEHIL4    138.00] AMP    31800.5   -86.13
533074 [45TH ST4    138.00] AMP    29218.3   -86.41
533413 [CIRCLE 3    115.00] AMP    22707.4   -85.87
533415 [DAVIS  3    115.00] AMP     8740.9   -82.40
533429 [MOUNDRG3    115.00] AMP     7183.3   -83.13
533438 [WMCPHER3    115.00] AMP    12423.9   -84.78
533653 [WOLFCRK2    69.000] AMP     6015.6   -87.23
533880 [GODDARD2    138.00] AMP    18934.8   -85.91
539631 [FLATRWD4    138.00] AMP     9753.6   -83.87
539668 [HARPER 4    138.00] AMP     5947.9   -79.19
539674 [BARBER 4    138.00] AMP     8017.7   -83.76
539805 [ELMCREEK7   345.00] AMP     5312.0   -85.44
560002 [IRONWOOD7   345.00] AMP    12893.6   -85.10
560053 [G15-052T    345.00] AMP    13222.6   -86.46
560070 [G16-001-TAP 345.00] AMP    13146.3   -86.31
560080 [G16-046-TAP 345.00] AMP    10729.2   -78.75
582008 [GEN-2011-008345.00] AMP    10497.8   -84.37
583090 [G1149&G1504 345.00] AMP     4642.3   -86.07
583370 [GEN-2012-024345.00] AMP    10870.5   -84.65
583750 [GEN-2013-029345.00] AMP    10490.8   -84.69
584980 [GEN-2015-060138.00] AMP     5662.3   -86.38
585100 [GEN-2015-073345.00] AMP    14235.6   -85.64
585180 [GEN-2015-081345.00] AMP    13490.6   -85.91
585410 [GREAT_WESTRN345.00] AMP     9783.8   -85.28
585430 [PRSIMN_CRK1 345.00] AMP    11383.1   -85.45
514715 [WOODRNG7    345.00] AMP    17294.0   -84.83
514785 [WOODWRD4    138.00] AMP    12156.8   -80.98
514787 [DEWEY  4    138.00] AMP     7181.1   -77.24
515448 [CRSRDSW7    345.00] AMP    11102.8   -85.54
515477 [CHSHLMV7    345.00] AMP    12423.3   -84.73
515497 [MATHWSN7    345.00] AMP    29657.1   -86.07
515546 [GRANTCO4    138.00] AMP     6278.4   -81.16
515569 [MDFRDTP4    138.00] AMP    10996.3   -83.46
515582 [SLNGWND7    345.00] AMP     8983.5   -85.26
515585 [MAMTHPW7    345.00] AMP    13253.8   -86.34
515621 [OPENSKY7    345.00] AMP    12866.2   -86.64
520409 [RENFROW4    138.00] AMP    10055.9   -83.15
525830 [TUCO_INT   6230.00] AMP    22300.6   -85.09
526936 [YOAKUM_345  345.00] AMP     8485.1   -86.27
530592 [SMOKYHL6    230.00] AMP     6936.0   -84.30
531469 [SPERVIL7    345.00] AMP    13287.2   -84.80
532766 [JEC N  7    345.00] AMP    23512.0   -87.51
532776 [DOUGLAS7    345.00] AMP    18181.4   -85.14
532780 [CANEYRV7    345.00] AMP     9934.8   -85.50
532801 [ELKRVR17    345.00] AMP     9282.6   -85.46
532802 [WAVERTX7    345.00] AMP    12593.9   -86.05
532856 [SWISVAL6    230.00] AMP    21666.7   -85.44
532863 [MORRIS 6    230.00] AMP    13849.2   -85.33
532871 [CIRCLE 6    230.00] AMP     9516.1   -84.81
532872 [EMCPHER6    230.00] AMP     8517.7   -83.90
532874 [UNIONRG6    230.00] AMP     8854.7   -83.66
532982 [OXFORD 4    138.00] AMP     9261.7   -82.99
532987 [BUTLER 4    138.00] AMP     9979.1   -79.37
532991 [WEAVER 4    138.00] AMP    22302.1   -83.88
532992 [TIMBJCT4    138.00] AMP     5701.7   -83.31
533012 [HALSTDS4    138.00] AMP     4264.5   -85.38
533013 [MOUND  4    138.00] AMP     4877.1   -84.82
533016 [WWUPLNT4    138.00] AMP     7756.0   -84.66
533029 [59TH ST4    138.00] AMP    18965.7   -83.67
533031 [BURNSTP4    138.00] AMP     4488.9   -76.59
533037 [COMOTAR4    138.00] AMP    18675.0   -84.58
533038 [COWSKIN4    138.00] AMP    20312.4   -85.57
533039 [ELPASO 4    138.00] AMP    25627.9   -84.16
533045 [GILL W 4    138.00] AMP    28372.2   -85.43
533049 [HOOVERN4    138.00] AMP    18847.1   -84.95
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533060 [NOEASTE4    138.00] AMP    20644.7   -84.71
533063 [SC10BEL4    138.00] AMP    10219.1   -81.97
533064 [17TH   4    138.00] AMP    18000.7   -84.51
533068 [STEARMN4    138.00] AMP    19919.5   -84.15
533304 [LANG   3    115.00] AMP    14468.0   -85.15
533336 [BLUSTEM3    115.00] AMP    17076.8   -86.54
533372 [PHILIPS3    115.00] AMP    12361.4   -84.25
533380 [SPRGCRK3    115.00] AMP     3618.3   -72.52
533381 [SUMMIT 3    115.00] AMP    17354.8   -86.40
533391 [MAIZEE 4    138.00] AMP    21891.6   -84.94
533412 [ARKVALJ3    115.00] AMP    10847.1   -83.58
533414 [CITIES 3    115.00] AMP     8883.1   -82.20
533419 [HEC    3    115.00] AMP    22178.8   -85.85
533422 [HEC U4 3    115.00] AMP    21778.6   -85.66
533426 [MANVILE3    115.00] AMP    10205.5   -83.83
533428 [MCPHER 3    115.00] AMP    11942.4   -84.75
533439 [WHEATLD3    115.00] AMP     7899.5   -83.95
533506 [DAVIS  2    69.000] AMP     7555.9   -82.29
533597 [MIDIAN 2    69.000] AMP    12285.0   -81.91
533626 [BURLJCT2    69.000] AMP     5025.4   -85.90
533629 [CC2SHAR2    69.000] AMP     4638.9   -81.31
533786 [CHISHLM2    69.000] AMP    18791.8   -85.38
533795 [GILL E 2    69.000] AMP    33847.5   -85.47
533796 [GILL W 2    69.000] AMP    33847.5   -85.47
539000 [RAGO   4    138.00] AMP     3601.4   -81.08
539001 [ANTHONY4    138.00] AMP     3615.5   -80.97
539639 [ELMCREK6    230.00] AMP     7339.4   -84.83
539675 [MILANTP4    138.00] AMP     7081.3   -75.28
539760 [BARBER 3    115.00] AMP     7886.7   -83.41
539803 [IRONWOOD7   345.00] AMP    12859.4   -84.49
542981 [LACYGNE7    345.00] AMP    25072.0   -86.87
560000 [G11-14-TAP  345.00] AMP    13375.8   -86.34
560027 [G14-074-TAP 345.00] AMP     6515.4   -85.15
578530 [FR3         345.00] AMP     5072.6   -85.71
582016 [GEN-2011-016345.00] AMP     7301.1   -81.54
582708 [G-2011-008-1345.00] AMP     8859.3   -84.08
584700 [GEN-2015-029345.00] AMP     9603.1   -84.60
584900 [GEN-2015-052345.00] AMP    13171.6   -86.44
585060 [GEN-2015-068345.00] AMP     9975.2   -85.87
585420 [COWBOY_RIDGE345.00] AMP     7579.5   -85.03
585440 [PRSIMN_CRK2 345.00] AMP    10413.8   -85.35
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11.15 L: Transient Stability Group 16

See next page.

MITSUBISHI ELECTRIC POWER PRODUCTS, INC.
POWER SYSTEMS ENGINEERING SERVICES
530 KEYSTONE DRIVE
WARRENDALE, PA 15086, U.S.A.

Phone: (724) 778-5111 Fax: (724) 778-5149
Home Page: www.meppi.com

Southwest Power Pool, Inc. (SPP)

DISIS-2015-002-4 (Group 16)
Definitive Impact Study

Final Report

REP-0097
Revision #00

October 2017

Submitted By:
Mitsubishi Electric Power Products, Inc. (MEPPI)
Power Systems Engineering Division
Warrendale, PA

Title: **DISIS-2015-002-4 (Group 16) Definitive Impact Study: Final Report REP-0097**
Date: October 2017
Author: Taylor L. Cramer; Engineer I, Power Systems Engineering Division *Taylor L. Cramer*
Reviewed: Nicholas W. Tenza; Engineer II, Power Systems Engineering Division *Nicholas W. Tenza*
Approved: Rajat Majumder; Section Manager, Power Systems Engineering Division *Rajat Majumder*

EXECUTIVE SUMMARY

SPP requested a Definitive Interconnection System Impact Study (DISIS). The DISIS required a Stability Analysis, Short-circuit Analysis, Power Factor Analysis, and Low Wind/No Wind Analysis detailing the impacts of the interconnecting projects as shown in Table ES-1.

Table ES-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-046	300	Vestes V110 2MW wind (584873)	Tandee (Neset) 345kV (659336)
GEN-2015-096	150	G.E. 2MW wind (585313)	HEARTRVR 230Kv (659448)
GEN-2015-098	100	G.E. 2MW wind (585343)	Beaverhill 230kV (652616)

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined there were multiple contingencies that resulted in voltage instability and high post-fault voltage recovery when all generation interconnection requests were at 100% output. No upgrades were identified in the Stability Analysis although generation curtailment is needed.

2016 Winter Peak

FLT48-PO was observed to have generators swinging offline and voltage instability. FLT48-PO is a prior outage contingency followed by a system adjustment. In order to mitigate these observed violations, the following recommended mitigation measures (system adjustments) were provided by SPP:

- Curtailment of G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- Curtailment of GI1414GEN W (Unit 1 reduced by 37.2 MW)

Similarly, FLT33-3PH, FLT34-3PH, and FLT35-3PH were observed to have bus voltages transiently recover above 1.2 p.u. after the fault was cleared. However, the voltage recovery for all three faults were determined to be prior existing conditions. It is recommended that the Transmission Owner investigate this issue further.

2017 Summer Peak

FLT48-PO was observed to have both undervoltage and overvoltage violations. It was determined that curtailing the following two units mitigated the voltage violations observed:

- G15-096-GEN1 (Unit 1 reduced by 66.5 MW)
- GI1414GEN W (Unit 1 reduced by 37.2 MW)

2025 Summer Peak

FLT48-PO was observed to have undervoltage violations, overvoltage violations, post-contingency final voltages greater than 1.1 p.u., and also generation tripping offline. It was determined that the following units should be curtailed to mitigate the voltage violations:

- Curtailment of G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- Curtailment of GI1414GEN W (Unit 1 reduced by 37.2 MW)

After applying the above mitigation for all study years, generation tripping offline, voltage violations, and voltage instability for all contingencies were mitigated. Generation curtailment is required for all study years in order to maintain the steady-state voltage within acceptable limits for FLT48-PO.

SUMMARY OF THE SHORT-CIRCUIT ANALYSIS

The Short-Circuit Analysis was performed on the 2017 Summer Peak and 2025 Summer Peak power flow cases for all study projects. Refer to Table ES-2 for a list of maximum fault currents observed for each study project for the 2017 Summer Peak case. Refer to Table ES-3 for a list of maximum fault currents observed for each study project for the 2025 Summer Peak case.

Table ES-2
List of Maximum Fault Currents Observed for Each Study Project for the 2017 Summer Peak Case

Study Project	POI Name	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-046	Tandee (Neset) 345 kV (659336)	4.63	15.50	ANTELOP-LNX3	345
GEN-2015-096	HEARTRVR 230 kV (659448)	5.83	16.78	MANDAN 7	115
GEN-2015-098	Beaverhill 230 kV (652616)	3.75	15.50	ANTELOP3	345

Table ES-3
List of Maximum Fault Currents Observed for Each Study Project for the 2025 Summer Peak Case

Study Project	POI Name	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-046	Tandee (Neset) 345 kV (659336)	4.85	16.08	ANTELOP3	345
GEN-2015-096	HEARTRVR 230 kV (659448)	5.92	19.48	MANDAN 7	115
GEN-2015-098	Beaverhill 230 kV (652616)	3.78	16.08	ANTELOP3	345

SUMMARY OF POWER FACTOR ANALYSIS

Refer to Table ES-4 for the power factor analysis results for each study generator. The table lists the range of power factor required for each study project.

Table ES-4
Power Factor Analysis Summary for Study Projects

Study Project	Power Factor Range for Each Study Project[1]					
	16WP		17SP		25SP	
GEN-2015-046	0.996	0.999	-0.984	-0.999	0.965	-0.999
GEN-2015-096	0.998	-0.981	0.995	-0.991	0.971	-0.996
GEN-2015-098	-0.989	1.000	0.996	-0.996	0.959	-0.997

[1]Lagging power factors are negative and leading power factors are positive

SUMMARY OF THE LOW/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the high side of the transformer near the point of interconnection for all study projects for each season. The maximum reactance needed for zero Mvar flow was -40 Mvar for GEN-2015-046. The minimum reactance needed for zero Mvar flow was -9.98 Mvar for GEN-2015-098.

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SECTION 1: OBJECTIVES

The objective of this report is to provide Southwest Power Pool, Inc. (SPP) with the deliverables for the DISIS-2015-002-4 (Group 16) Definitive Impact Study. SPP requested an Interconnection System Impact Study for three (3) generation interconnections for 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak, which requires a Stability Analysis, Short-circuit Analysis, Power Factor Analysis, Low/No Wind/Solar Irradiance Analysis, and an Impact Study Report.

SECTION 2: BACKGROUND

The Siemens Power Technologies International PSS/E power system simulation program Version 32.2.0 was used for this study. SPP provided the stability database cases for 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak conditions and a list of contingencies to be examined. The model includes the study projects shown in Table 2-1 and the previously queued projects listed in Table 2-2. Refer to Appendix A for the steady-state and dynamic model data for the study projects. A power flow one-line diagram for each generation interconnection project is shown in Figures 2-1 through 2-3. Note that the one-line diagrams represent the 2016 Winter Peak case.

The Stability Analysis determined the impacts of the new interconnecting projects on the stability and voltage recovery of the nearby system and the ability of the interconnecting projects to meet FERC Order 661A. If problems with stability or voltage recovery are identified, the need for reactive compensation or system upgrades will be investigated. Three-phase faults and single line-to-ground faults will be examined as listed in Table 2-3.

A Short-Circuit Analysis was performed on the 2017 Summer Peak and 2025 Summer Peak study years for each study generator. The study was performed five buses out from the study generator's point of interconnection and results were documented.

The Power Factor Analysis determined the power factor at the high side of the transformer near the point of interconnection for the wind and solar interconnection projects for pre-contingency and post-contingency conditions. The N-1, three phase contingencies listed in Table 2-3 were used in the Power Factor analysis.

The Summary of the Low/No Wind Analysis was completed for all wind and solar farm interconnections. This analysis determined if reactive support is needed from the interconnecting generation plants to have a Mvar flow of approximately zero at the point of interconnection (POI) from the grid.

Table 2-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-046	300	Vestes V110 2MW wind (584873)	Tandee (Neset) 345 kV (659336)
GEN-2015-096	150	G.E. 21MW wind (585313#1) & GE 1.79MW (585313#2)	HEARTRVR 230 kV (659448)
GEN-2015-098	100	G.E. 2.3MW wind (585343)	Beaverhill 230 kV (652616)

Table 2-2
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
GI-0708	120.0	GENROU (659270, ID 1)	Culbertson 115kV (661012)
G645/G788	102.6	GENROU (615015, ID 1)	Spiritwd 115kV (620270)
G752	150.0	WT3 generic wind (661989)	Hettinger 230kV (661047) 230kV
G723	7.0	GENSAL (661046)	Heskett 115kV (661043)
J003	19.5	WT3 generic wind (661317)	Baker 60kV (661300)
G502	50.6	W4GUR wind (608603)	SQBUTTE 230kV (657756)
G408	11.9	WT1 generic wind (600059)	Velva Tap 115kV (605634)
G380	149.1	Suzlon S88 2.1MW (620115)	Rugby 230kV (620379)
J262/J263	200.0	Vestas V100 2.0MW (600162/600163)	Jamestown 115kV (620269)
G830	99.8	Vestas V100 1.8MW (10648)	McHenry 115kV (615348)
GI-0614A	7.5	GENSAL (659270, ID 2)	Culbertson 115kV (661012)
GI-0508	49.5	WT3 generic wind (659294)	Hilken 230kV (652466)
GI-0615	49.5	WT3 generic wind (659273)	Hilken 230kV (652466)
GI-0715	100.0	WT3 generic wind (659366)	Hilken 230kV (652466)
GI-0926	106.5	GENROU (659403)	Hebron 230kV (652468)
GI-1001	99.0	GENROU (659411)	Mound City 230kV (652499)
GI-1007	172.5	GENROU (659407)	Antelope Valley 345kV (659101)
GI-1105, GI-1205, GI-1207	141.0	GENROU (659147/ 659158/ 659159)	Williston 115kV (652421)
GI-1202, GI-1204, GI-1208	141.0	GENROU (659148/ 659156/ 659157)	EASTHYBT-MK 115kV (659587
GI-1206	141.0	GENROU (659162/ 659163/ 659192)	Patentgate 115kV (659391)
GI-1212	75.0	GEWTG2 (910006)	Circle (652401) to Wolf Point (652409) 115kV (910007)
GI-1404	384.2	GE 1.7MW (659125)	Charlie Creek 345kV (659183)
GI-1406	113.3	GENSAL (659431 ID's A1-A6/ 659432 ID's B1-B6)	PNSCOLLECTR 115kV (659430)
GI-1410	150.0	Vestas V110 VCSS 2.0MW (659141)	Neset 115kV (659139)
GI-1414	149.7	GE 1.715MW & 1.79MW wind (659453)	HEARTRVR 230kV (659448)
GEN-2014-003IS	88.2	WT3 generic wind (659018)	Culbertson 115kV (661012)
J249	180.0	WT3 generic wind (661999)	MDU Tatanka Substation (661096)
J290	150.0	Vestas V110 2.0MW (600161)	230 kV Rugby to Glenboro (602057)
J316	150.0	GE 1.7MW (11115)	MDU 230 kV Tatanka-Ellendale line (11117)
J405	40.0	GENSAL (11160)	MDU Lewis & Clark sub (661056)
J490	60.0	WT3 generic wind (587613)	McIntosh 115kV (661041)
MPCO1200	49.3	GE 1.7MW (657988)	Sibley 230kV (657734)
MPCO2100	100.0	GE 2.0MW (657745)	Center (657751) to Mandan (661053) 230kV (657741)

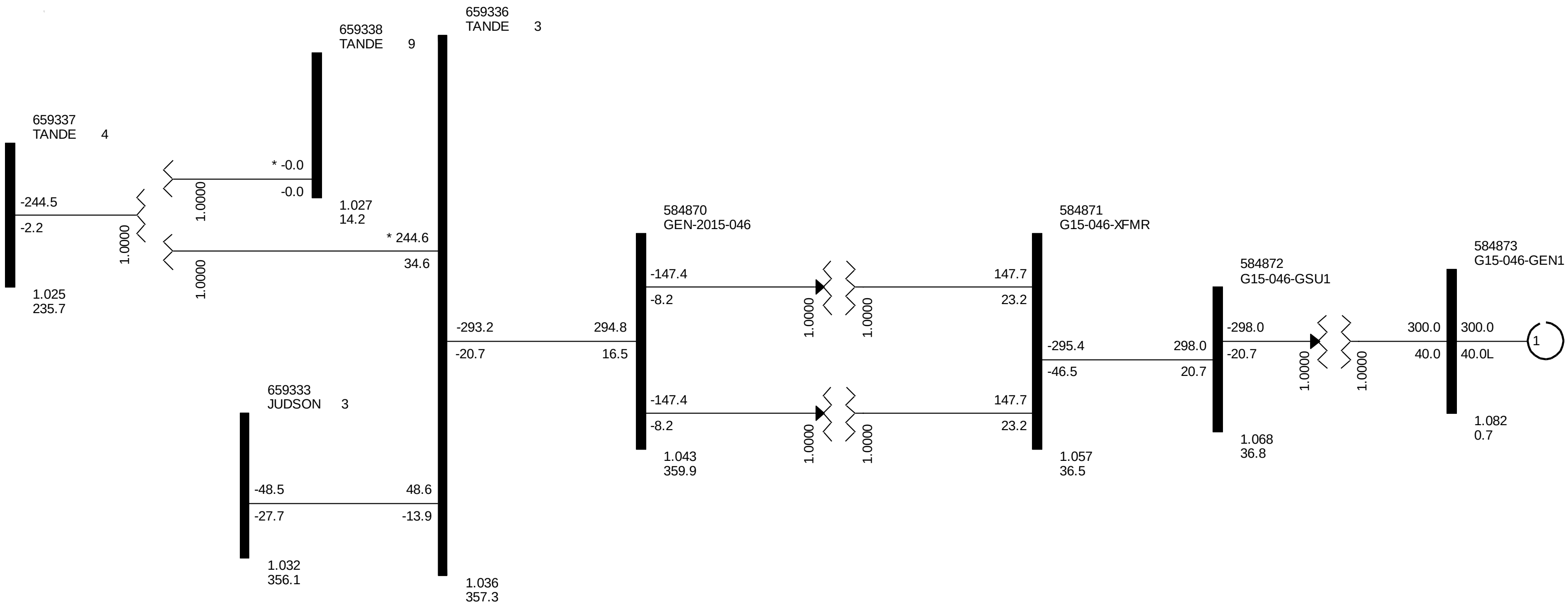

Figure 2-1. Power flow one-line diagram for interconnection project at the Tandee (Neset) 345kV POI (GEN-2015-046).

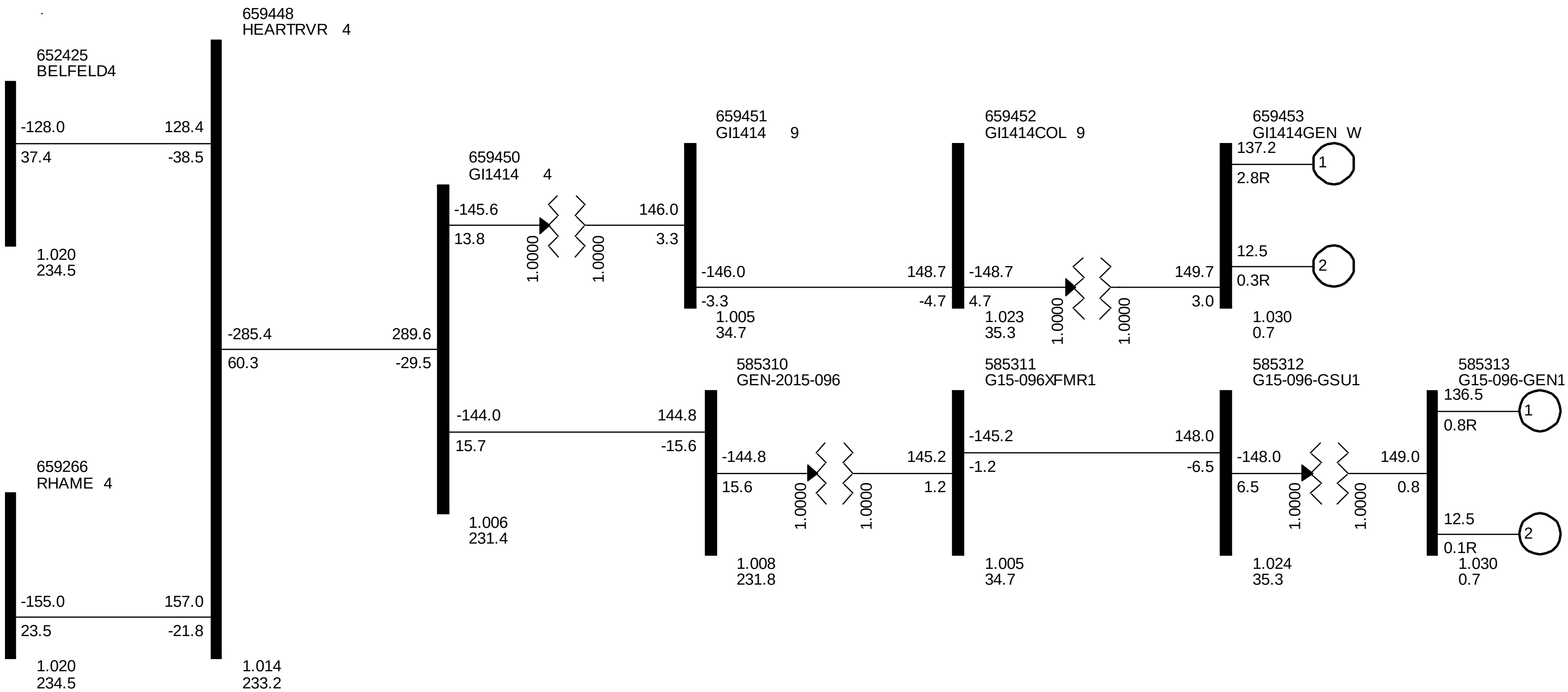

Figure 2-2. Power flow one-line diagram for interconnection project at the HEARTRVR 230kV POI (GEN-2015-096).

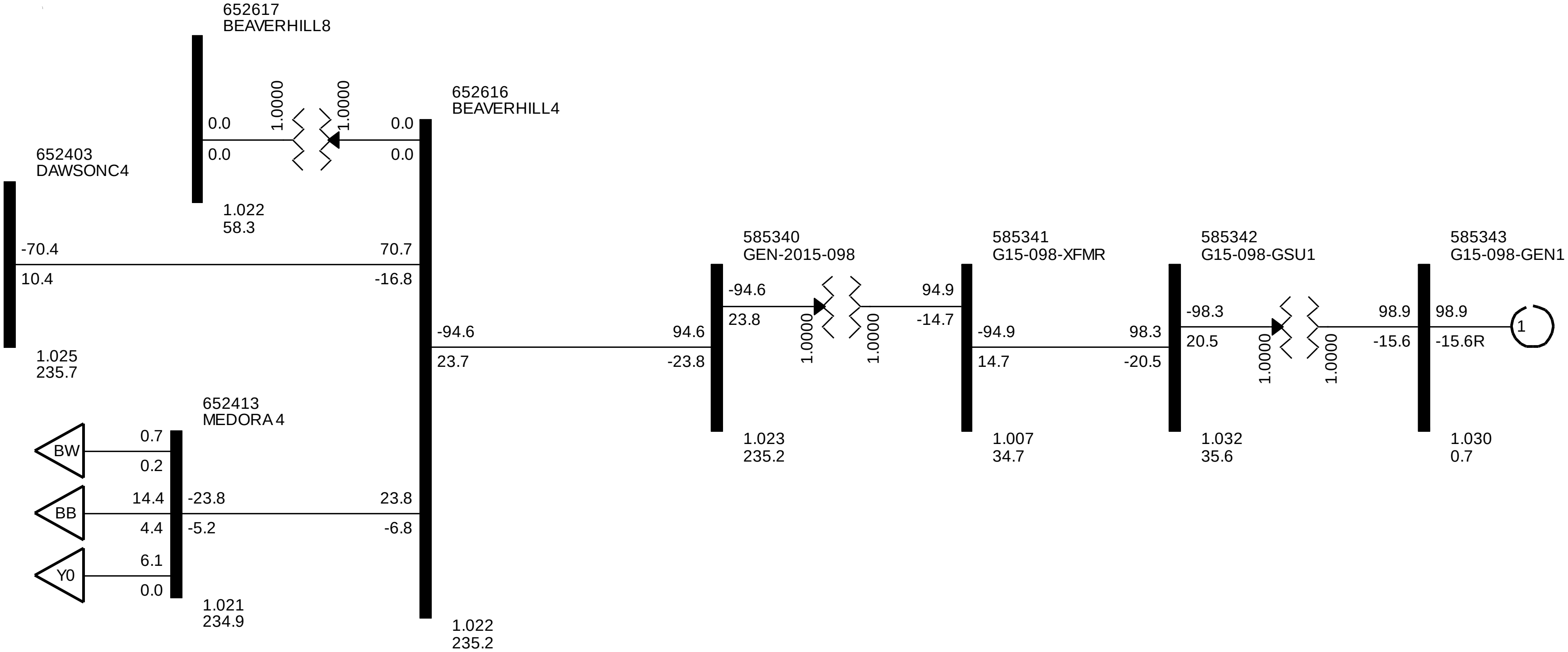

Figure 2-3. Power flow one-line diagram for interconnection project at the Beaverhill 230kV POI (GEN-2015-098).

Table 2-3
Case List with Contingency Description

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on Tandee 345kV (659336) to Judson 345kV (659333) CKT 1, near Tandee. a. Apply fault at the Tandee 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-3PH	3 phase fault on the Tandee 345kV (659336) to Tandee 230kV (659337) to Tandee 13.8kV (659338) XFMR CKT 1, near Tandee 345kV. a. Apply fault at the Tandee 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
3	FLT03-3PH	3 phase fault on the Judson 345kV (659333) to Patentgate 345kV (659390) CKT 1, near Judson. a. Apply fault at the Judson 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT04-3PH	3 phase fault on the Patentgate 345kV (659390) to Patentgate 115kV (659391) to Patentgate 13.8kV (659392) XFMR CKT 1, near Patentgate 345kV. a. Apply fault at the Patentgate 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
5	FLT05-3PH	3 phase fault on the Judson 345kV (659333) to Judson 230kV (659334) to Judson 13.8kV (659335) XFMR CKT 1, near Judson 345kV. a. Apply fault at the Judson 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
6	FLT06-3PH	3 phase fault on the Kummer Ridge 345kV (659387) to Round Up 345kV (659384) CKT 1, near Kummer Ridge. a. Apply fault at the Kummer Ridge 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
7	FLT07-3PH	3 phase fault on the Charlie Creek 345kV (659183) to Round Up 345kV (659384) CKT 1, near Charlie Creek. a. Apply fault at the Charlie Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT08-3PH	3 phase fault on the Charlie Creek 345kV (659183) to Antelope 345kV (659101) CKT 1, near Charlie Creek. a. Apply fault at the Charlie Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
9	FLT09-3PH	3 phase fault on the Charlie Creek 345kV (659183) to Belfield 345kV (659101) CKT 1, near Charlie Creek. a. Apply fault at the Charlie Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10-3PH	3 phase fault on the Charlie Creek 345kV (659183) to Charlie Creek 230kV (659302) to Charlie Creek 13.8kV (659319) XFMR CKT 2, near Charlie Creek a. Apply fault at the Charlie Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
11	FLT11-3PH	3 phase fault on the Neset 230kV (659138) to Neset 115kV (659139) to Neset 13.8kV (659146) XFMR CKT 1, near Neset 230kV. a. Apply fault at the Neset 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12	FLT12-3PH	3 phase fault on the Tandee 230kV (659337) to Neset 230kV (659337) CKT 1, near Tandee. a. Apply fault at the Tandee 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13	FLT13-3PH	3 phase fault on the Tioga 230kV (661084) to Wheelock 230kV (659362) CKT 1, near Tioga. a. Apply fault at the Tioga 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT14-3PH	3 phase fault on the Tioga 230kV (661084) to Tioga 115kV (661085) to Tioga 13.8kV (661900) XFMR CKT 1, near Tioga 230kV. a. Apply fault at the Tioga 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
15	FLT15-3PH	3 phase fault on the Neset 115kV (659139) to Tioga 115kV (661085) CKT 1, near Neset. a. Apply fault at the Neset 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16-3PH	3 phase fault on the Blaisdell 230kV (659143) to Logan 230kV (659108) CKT 1, near Blaisdell. a. Apply fault at the Blaisdell 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
17	FLT17-3PH	3 phase fault on the Belfield 345kV (652424) to Belfield 230kV (652425) to Belfield 13.8kV (652221) XFMR CKT 1, near Belfield 230kV. a. Apply fault at the Belfield 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
18	FLT18-3PH	3 phase fault on the G15-091096-Tap 230kV (G15091) to Belfield 230kV (652425) CKT 1, near G15-091096-Tap. a. Apply fault at the G15-091096-Tap 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
19	FLT19-3PH	3 phase fault on the G15-091096-Tap 230kV (G15091) to Rhame 230kV (659266) CKT 1, near G15-091096-Tap. a. Apply fault at the G15-091096-Tap 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT20-3PH	3 phase fault on the Belfield 230kV (652425) to Dickinson 230kV (652417) CKT 1, near Belfield. a. Apply fault at the Belfield 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT21-3PH	3 phase fault on the Belfield 230kV (652425) to Medora 230kV (652413) CKT 1, near Belfield. a. Apply fault at the Belfield 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT22-3PH	3 phase fault on the Belfield 230kV (652425) to S Heart 230kV (659309) CKT 1, near Belfield. a. Apply fault at the Belfield 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23	FLT23-3PH	3 phase fault on the Rhame 230kV (659266) to Bowman 230kV (661010) CKT 1, near Rhame. a. Apply fault at the Rhame 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24-3PH	3 phase fault on the Rhame 230kV (659266) to Little Missouri 230kV (659265) CKT 1, near Rhame. a. Apply fault at the Rhame 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT25-3PH	3 phase fault on the Rhame 230kV (659266) to Rhame 115kV (659207) XFMR CKT 1, near Rhame 230kV. a. Apply fault at the Rhame 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
26	FLT26-3PH	3 phase fault on the Baker 230kV (661004) to Miles City 230kV (652411) CKT 1, near Baker. a. Apply fault at the Baker 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT27-3PH	3 phase fault on the Baker 230kV (661004) to Baker 115kV (661005) to Baker 13.8kV (661901) XFMR CKT 1, near Baker 230kV. a. Apply fault at the Baker 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
28	FLT28-3PH	3 phase fault on the Bowman 230kV (661010) to Bowman 115kV (659340) to Bowman 13.8kV (659340) XFMR CKT 1, near Bowman 230kV. a. Apply fault at the Bowman 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
29	FLT29-3PH	3 phase fault on the Bowman 230kV (661010) to Hettinger 230kV (661047) CKT 1, near Bowman. a. Apply fault at the Bowman 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT30-3PH	3 phase fault on the Hebron 230kV (652468) to Mandan 230kV (661053) CKT 1, near Hebron. a. Apply fault at the Hebron 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
31	FLT31-3PH	3 phase fault on the Beaver Hill 230kV (652616) to Medora 230kV (652413) CKT 1, near Beaver Hill. a. Apply fault at the Beaver Hill 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT32-3PH	3 phase fault on the Beaver Hill 230kV (652616) to Dawson County 230kV (652403) CKT 1, near Beaver Hill. a. Apply fault at the Beaver Hill 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
33	FLT33-3PH	3 phase fault on the Dawson County 230kV (652403) to Miles City 230kV (652411) CKT 1, near Dawson County. a. Apply fault at the Dawson County 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT34-3PH	3 phase fault on the Dawson County 230kV (652403) to Coal Hill 230kV (652111) CKT 1, near Dawson County. a. Apply fault at the Dawson County 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
35	FLT35-3PH	3 phase fault on the Dawson County 230kV (652403) to Dawson County 115kV (652404) to Dawson County 13.8kV (652211) XFMR CKT 1, near Dawson County 230kV. a. Apply fault at the Dawson County 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
36	FLT36-3PH	3 phase fault on the Coal Hill 230kV (652111) to Ft Peck 230kV (652405) CKT 1, near Coal Hill. a. Apply fault at the Coal Hill 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT37-3PH	3 phase fault on the Dawson County 115kV (652404) to Lewis 115kV (661056) CKT 1, near Dawson County. a. Apply fault at the Dawson County 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38	FLT38-3PH	3 phase fault on the Dawson County 115kV (652404) to Fallon 115kV (652407) CKT 1, near Dawson County. a. Apply fault at the Dawson County 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
39	FLT39-3PH	3 phase fault on the Dawson County 115kV (652404) to Circle 115kV (652401) CKT 1, near Dawson County. a. Apply fault at the Dawson County 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT40-3PH	3 phase fault on the Dawson County 115kV (652404) to Glendive 115kV (661032) CKT 1, near Dawson County. a. Apply fault at the Dawson County 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT41-PO	**Prior Outage of Tandee Transformer**. 3 phase fault on the Patentgate to Charlie Creek 345kV. a. Prior outage Tandee (659336) 345kV to Tandee (659337) 230kV to Tandee (659338) 13.8 kV XFMR (solve network for steady state solution). b. 3 phase fault on the Patentgate (659390) 345kV to Charlie Creek (659183) 345kV, near Patengate 345kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
42	FLT42-PO	**Prior Outage of Tandee Transformer**. 3 phase fault on the Judson Transformer. a. Prior outage Tandee (659336) 345kV to Tandee (659337) 230kV to Tandee (659338) 13.8 kV XFMR (solve network for steady state solution). b. 3 phase fault on the Judson (659333) 345kV to Judson (659334) 230kV to Judson (659335) 13.8 kV XFMR, near Judson 345kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
43	FLT43-PO	**Prior Outage of Tandee to Judson 345kV**. 3 phase fault on the Neset to Tioga 230kV. a. Prior outage Tandee (659336) 345kV to Judson (659333) 345kV (solve network for steady state solution). b. 3 phase fault on the Neset (659138) 230kV to Tioga (661084) 230kV, near Neset 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
44	FLT44-SB	**Tandee 230kV Stuck Breaker** a. Apply single phase fault at the Tandee (659337) 230kV bus on the Tandee – Neset (659138) 230kV line. b. Wait 16 cycles, and then drop Tandee (659337) 230kV to Neset (659138) 230kV line. c. Trip Tandee (659336) 345kV to Tandee (659337) 230kV to Tandee (659338) 13.8kV XFMR and remove the fault.
45	FLT45-SB	**Patentgate 345kV Stuck Breaker** a. Apply single phase fault at the Patentgate (659390) 345kV bus on the Patentgate – Charlie Creek (659183) 345kV line. b. Wait 16 cycles, and then drop Patentgate (659390) 345kV to Kummer Ridge (659387) 345 kV line. c. Trip Patentgate to Charlie Creek 345kV and remove the fault.
46	FLT46-SB	**Charlie Creek 345kV Stuck Breaker** a. Apply single phase fault at the Charlie Creek (659183) 345kV bus on the Charlie Creek – Round Up (659384) 345kV line. b. Wait 16 cycles, and then drop Charlie Creek (659183) 345kV to Antelope (659101) 345kV line. c. Trip Charlie Creek to Round Up 345kV and remove the fault.
47	FLT47-PO	**Prior Outage of Belfield to Dickinson 230kV**. 3 phase fault on the Belfield – Medora 230kV line. a. Prior outage Belfield (652425) 230kV to Dickinson (652417) 230kV (solve network for steady state solution). b. 3 phase fault on the Belfield (652425) 230kV to Medora (652413) 230kV, near Belfield 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
48	FLT48-PO	**Prior Outage of Belfield to G15-091096-Tap 230kV**. 3 phase fault on the Rhame – Bowman 230kV line. a. Prior outage Belfield (652425) 230kV to G15-091096-Tap (G15091) 230kV (solve network for steady state solution). b. 3 phase fault on the Rhame (659266) 230kV to Bowman (661010) 230kV, near Rhame 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
49	FLT49-PO	**Prior Outage of Rhame to G15-091096-Tap 230kV**. 3 phase fault on the Belfield – Medora 230kV line. a. Prior outage Rhame (659266) 230kV to G15-091096-Tap (G15091) 230kV (solve network for steady state solution). b. 3 phase fault on the Belfield (652425) 230kV to Medora (652413) 230kV, near Belfield 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
50	FLT50-SB	**Belfield 230kV Stuck Breaker** a. Apply single phase fault at the Belfield (652425) 230kV bus on the Belfield – Medora (652413) 230kV line. b. Wait 16 cycles, and then trip Belfield (652425) to Medora (652413) 230kV. c. Trip Belfield (652425) to G15-091096-Tap (G15091) 230kV and remove the fault.
51	FLT51-SB	**Rhame 230kV Stuck Breaker** a. Apply single phase fault at the Rhame (659266) 230kV bus on the Rhame – Little Missouri (659265) 230kV line. b. Wait 16 cycles, and then trip Rhame (659266) to Little Missouri (659265) 230kV. c. Trip Rhame (659266) to G15-091096-Tap (G15091) 230kV and remove the fault.
52	FLT52-PO	**Prior Outage of Dawson County to Miles City 230kV**. 3 phase fault on the Dawson County – Coal Hill 230kV line. a. Prior outage Dawson County (652403) 230kV to Miles City (652411) 230kV (solve network for steady state solution). b. 3 phase fault on the Dawson County (652403) 230kV to Coal Hill (652111) 230kV, near Dawson County 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
53	FLT53-PO	**Prior Outage of Dawson County Transformer**. 3 phase fault on the Dawson County – Miles City 230kV line. a. Prior outage Dawson County (652403) 230kV to Dawson County (652404) 115kV to Dawson County (652211) 13.8kV transformer (solve network for steady state solution). b. 3 phase fault on the Dawson County (652403) 230kV to Miles City (652411) 230kV, near Dawson County 230kV. c. Leave fault on for 5 cycles, then trip the faulted line in (b).
54	FLT54-SB	**Medora 230kV Stuck Breaker** a. Apply single phase fault at the Medora (652413) 230kV bus on the Medora – Beaver Hill (652616) 230kV line. b. Wait 16 cycles, and then trip Medora (652413) to Belfield (652425) 230kV. c. Trip Medora to Beaver Hill (652616) 230kV and remove the fault.
55	FLT55-SB	**Dawson County 230kV Stuck Breaker** a. Apply single phase fault at the Dawson County (652403) 230kV bus on the Dawson County – Beaver Hill (652616) 230kV line. b. Wait 16 cycles, and then trip Dawson County (652403) to Miles City (652411) 230kV. c. Trip Dawson County to Beaver Hill (652616) 230kV and remove the fault.
56	FLT56-SB	**Dawson County 115kV Stuck Breaker** a. Apply single phase fault at the Dawson County (652404) 115kV bus on the Dawson County – Lewis (661056) 115kV line. b. Wait 16 cycles, and then trip Dawson County (652404) to Glendive (661032) 115kV. c. Trip Dawson County to Lewis (661056) 115kV and remove the fault.
57	FLT57-SB	**Dawson County 115kV Stuck Breaker** a. Apply single phase fault at the Square Butte (657756) 230kV bus on the Square Butte – Stanton (615901) 230kV line. b. Wait 1 cycle, and then block Square Butte (657756) to Arrowhead (60865) DC Line. c. Wait 10 cycles, and then remove the fault and trip Square Butte (657756) to Stanton (615901) 230kV line. d. Wait 6 cycles, and then unblock Square Butte (657756) to Arrowhead (608615) DC Line.

SECTION 3: STABILITY ANALYSIS

The objective of the Stability Analysis was to determine the impacts of the generator interconnections on the stability and voltage recovery on the SPP transmission system. If problems with stability or voltage recovery were identified, the need for reactive compensation or system upgrades was investigated.

3.1 Approach

SPP provided MEPPI with the following three power flow cases:

- MDWG15-16WP_DIS15024_G16_R1
- MDWG15-17SP_DIS15024_G16_R1
- MDWG15-25SP_DIS15024_G16_R1

Each case was examined prior to the Stability Analysis to ensure the case contained the proposed study projects and any previously queued projects listed in Tables 2-1 and 2-2 respectively. There was no suspect power flow data in the study area. The dynamic datasets were also verified and stable initial system conditions (i.e., "flat lines") were achieved. Three-phase and single phase-to-ground faults listed in Table 2-3 were examined. Single-phase fault impedances were calculated for each season to result in a voltage of approximately 60% of the pre-fault voltage. Refer to Table 3-1 for a list of the calculated single-phase fault impedances.

Table 3-1
Calculated Single-Phase Fault Impedances

*Cont. No.	Cont. Name	Single-Phase Fault Admittance (MVA)		
		2016 Winter	2017 Summer	2025 Summer
1	16WP_FLT44_1PH_SB	-2144.5	-2000	-2144.5
2	16WP_FLT45_1PH_SB	-2867.2	-2867.2	-3011.7
3	16WP_FLT46_1PH_SB	-4312.5	-4023.4	-4312.5
4	16WP_FLT50_1PH_SB	-2578.1	-2433.6	-2433.6
5	16WP_FLT51_1PH_SB	-1125	-1125	-1125
6	16WP_FLT54_1PH_SB	-1500	-1437.5	-1500
7	16WP_FLT55_1PH_SB	-1250	-1250	-1250
8	16WP_FLT56_1PH_SB	-1125	-1125	-1125
9	16WP_FLT57_1PH_SB	-5468.8	-5468.8	-5468.8

*** Refer to Table 2-3 for a description of the contingency scenario**

Bus voltages, machine rotor angles, and previously queued generation in the study area were monitored in addition to bus voltages and machine rotor angles in the following areas:

- 640 NPPD
- 645 OPPD
- 650 LES
- 652 WAPA
- 600 XEL
- 608 MP
- 613 SMMPA
- 615 GRE
- 620 OTP
- 661 MDU

The results of the analysis determined if reactive compensation or system upgrades were required to obtain acceptable system performance.

3.2 Stability Analysis Results

The Stability Analysis determined there were several contingencies that resulted in voltage violations, system instability, or generation tripping offline for the 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak conditions when all generation interconnection requests were at 100% output.

Refer to Table 3-2 for a summary of the Stability Analysis results for the contingencies listed in Table 2-3. Table 3-2 is a summary of the stability results for the 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak conditions and states whether the system remained stable or generation tripped offline, if acceptable voltage recovery was observed after the fault was cleared, and if the voltage recovered to above 0.9 p.u. and below 1.1 p.u. post fault steady-state conditions. Voltage recovery criteria includes ensuring that the transient voltage recovery is between 0.7 p.u. and 1.2 p.u. and ending in a steady-state voltage (for N-1 contingencies) at the pre-contingent level or at least above 0.9 p.u. and below 1.1. p.u.

Table 3-2
Stability Analysis Summary of Results for 2016 Winter, 2017 Summer, and 2025 Summer Peak Conditions

(1)Cont. No.	Cont. Name	2016 Winter Peak				2017 Summer Peak				2025 Summer Peak			
		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault		Voltage Recovery		Post Fault	
		Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability	Less than .70 p.u.	Greater than 1.20 p.u.	Steady-State Voltage	System Stability
1	FLT01-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
2	FLT02-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
3	FLT03-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
4	FLT04-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
5	FLT05-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
6	FLT06-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
7	FLT07-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
8	FLT08-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
9	FLT09-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
10	FLT10-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
11	FLT11-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
12	FLT12-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
13	FLT13-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
14	FLT14-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
15	FLT15-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
16	FLT16-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
17	FLT17-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
18	FLT18-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
19	FLT19-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
20	FLT20-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
21	FLT21-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
22	FLT22-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
23	FLT23-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
24	FLT24-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
25	FLT25-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
26	FLT26-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
27	FLT27-1PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
28	FLT28-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
29	FLT29-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
30	FLT30-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
31	FLT31-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
32	FLT32-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
33	FLT33-3PH	-	Yes	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
34	FLT34-3PH	-	Yes	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
35	FLT35-3PH	-	Yes	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
36	FLT36-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
37	FLT37-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
38	FLT38-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
39	FLT39-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
40	FLT40-3PH	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
41	FLT41-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
42	FLT42-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
43	FLT43-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
44	FLT44-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
45	FLT45-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
46	FLT46-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
47	FLT47-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
(2)48	FLT48-PO	Yes	Yes	Not Compliant	Gen Trip	-	Yes	V > 1.1	Gen Trip	Yes	Yes	V > 1.1	Gen Trip
49	FLT49-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
50	FLT50-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
51	FLT51-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
52	FLT52-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
53	FLT53-PO	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
54	FLT54-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
55	FLT55-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
56	FLT56-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable
57	FLT57-1PH-SB	-	-	Compliant	Stable	-	-	Compliant	Stable	-	-	Compliant	Stable

(1) Refer to Table 2-3 for a description of the contingency scenario
(2) FLT48-PO required curtailment of GEN-2015-096 and GI1414 after the prior outage

2016 Winter Peak

For the 2016 Winter Peak case, one contingency resulted in generators tripping offline and voltage instability. Contingency FLT48-PO had four generators that show wind plant instability. The following generators showing instability were:

- G15-098-GEN1 (585343) Unit 1
- G12_012lS_3 (910006) Unit 1
- GI1414GEN W (659453) Units 1 and 2

Voltage instability was observed for contingency FLT48-PO for the following buses:

- RHAME 7
- RHAME 4
- HEARTRVR 4
- LTLMISS7
- LTLMISS4
- GI1414 4
- BAKER 4
- GEN-2015-096

FLT48-PO is a prior outage contingency with system adjustments. In order to mitigate the voltage instability observed for contingency FLT48-PO, curtailment of two units was required:

- G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- GI1414GEN W (Unit 1 reduced by 37.2 MW)

Once the output of both units were reduced, there are no more voltage instability issues or generators swinging offline.

Contingencies FLT33-3PH, FLT34-3PH, and FLT35-3PH were observed to have pre-existing overvoltage violations. It is recommended that the Transmission Owner investigate the voltage recovery for these faults.

Generation curtailment was required for GEN-2015-046 in order to maintain the steady-state voltage within acceptable limits for FLT48-PO. Refer to Figures 3-1 through 3-4 for stability plots of the violations observed for the 2016 Winter Peak case.

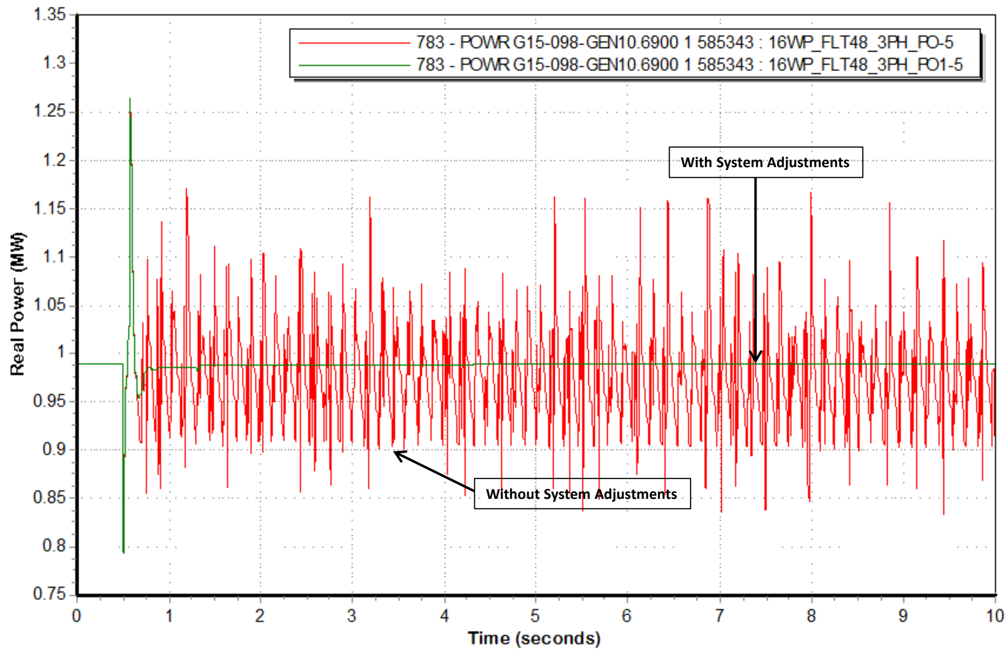

Figure 3-1. Plot of the real power at G15-098-GEN1 for FLT48-PO for 2016 Winter Peak case with and without system adjustments.

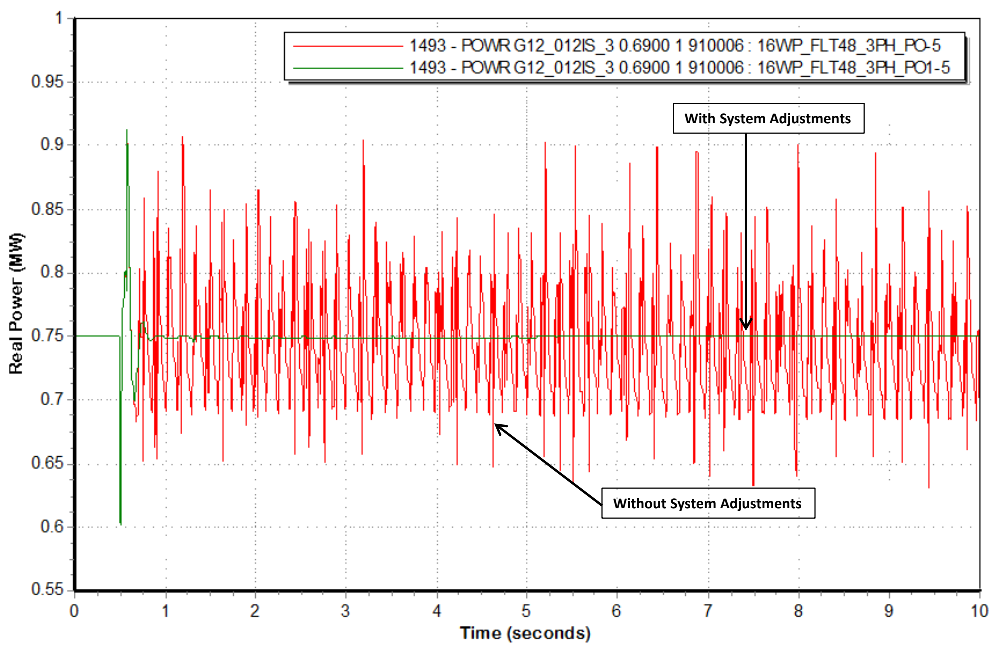

Figure 3-2. Plot of the real power at G12_012IS_3 for FLT48-PO for 2016 Winter Peak case with and without system adjustments.

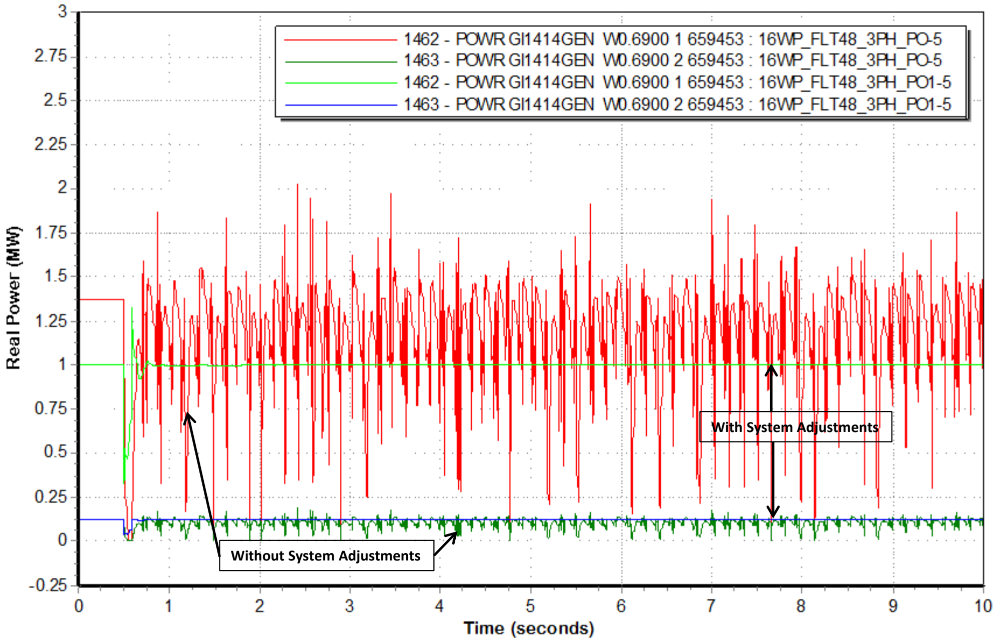

Figure 3-3. Plot of the real power at GI1414GEN for FLT48-PO for 2016 Winter Peak case with and without system adjustments.

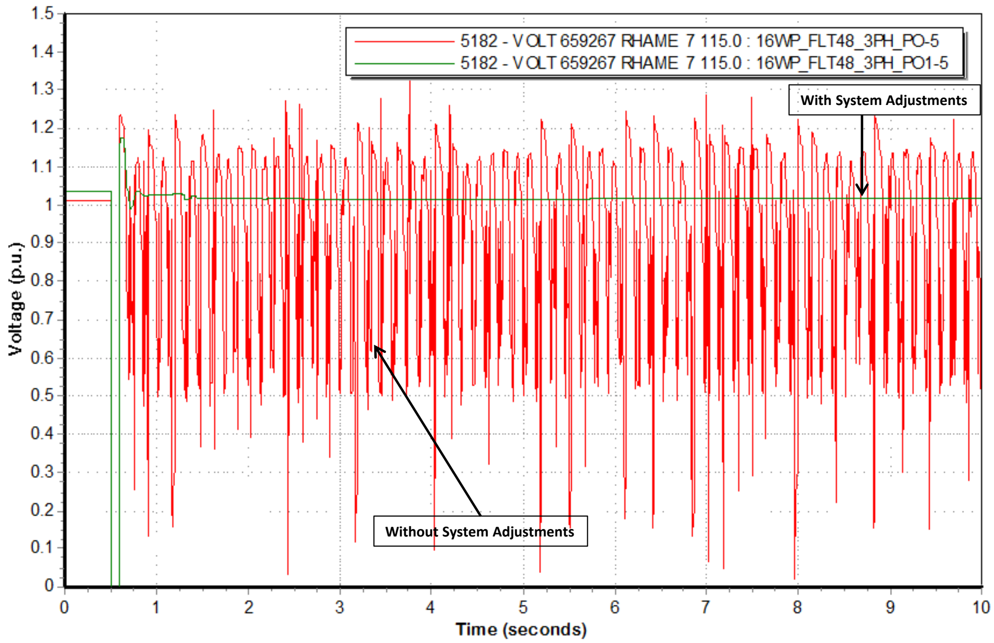

Figure 3-4. Plot of the voltage at RHAME 7 for FLT48-PO for 2016 Winter Peak case with and without system adjustments.

2017 Summer Peak

Voltage violations and generation tripping offline was observed for the 2017 Summer Peak case. Note that the majority of the contingencies were observed to have post-contingency final voltages greater than 1.1 p.u. for the ROSEAUN2 (601012) 500 kV bus because the pre-fault voltage for this bus is 1.105 p.u. One contingency caused generators to trip offline. Contingency FLT48-PO had the following four generators tripping offline:

- G15-096-GEN1 (585313) Units 1 and Unit 2
- GI1414GEN W (659453) Units 1 and Unit 2

Contingencies FLT48-PO was observed to have overvoltage violations. Contingency FLT48-PO was observed to have post-contingency final voltages greater than 1.1 p.u. for several buses. In order to mitigate undervoltage and overvoltage violations for this contingency, curtailment of two units was required:

- G15-096-GEN1 (Unit 1 reduced by 66.5 MW)
- GI1414GEN W (Unit 1 reduced by 37.2 MW)

Once the output of both units were reduced, there were no more voltage violations or generators swinging offline.

Refer to Figures 3-5 through 3-7 for stability plots of the violations observed for the 2017 Summer Peak case.

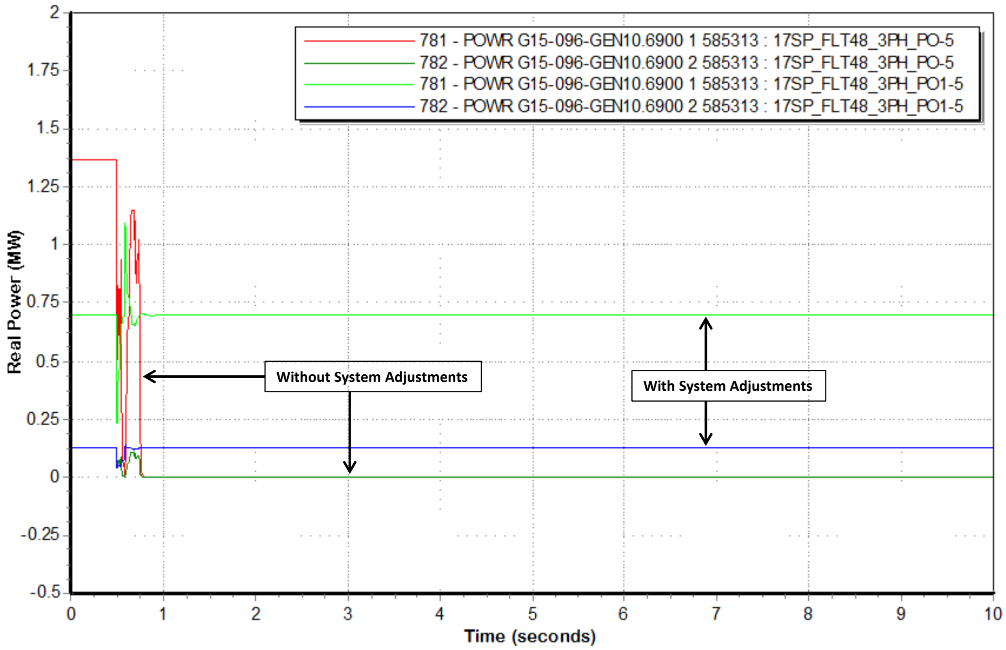

Figure 3-5. Plot of the real power at G15-096-GEN1 for FLT48-PO for 2017 Summer Peak case with and without system adjustments.

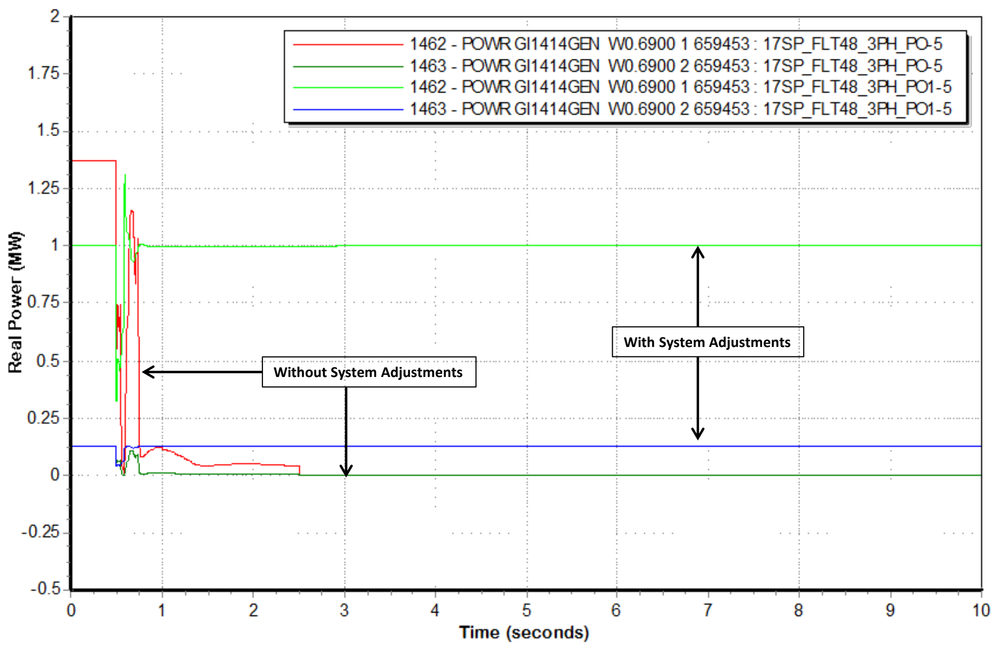

Figure 3-6. Plot of the real power at GI1414GEN for FLT48-PO for 2017 Summer Peak case with and without system adjustments.

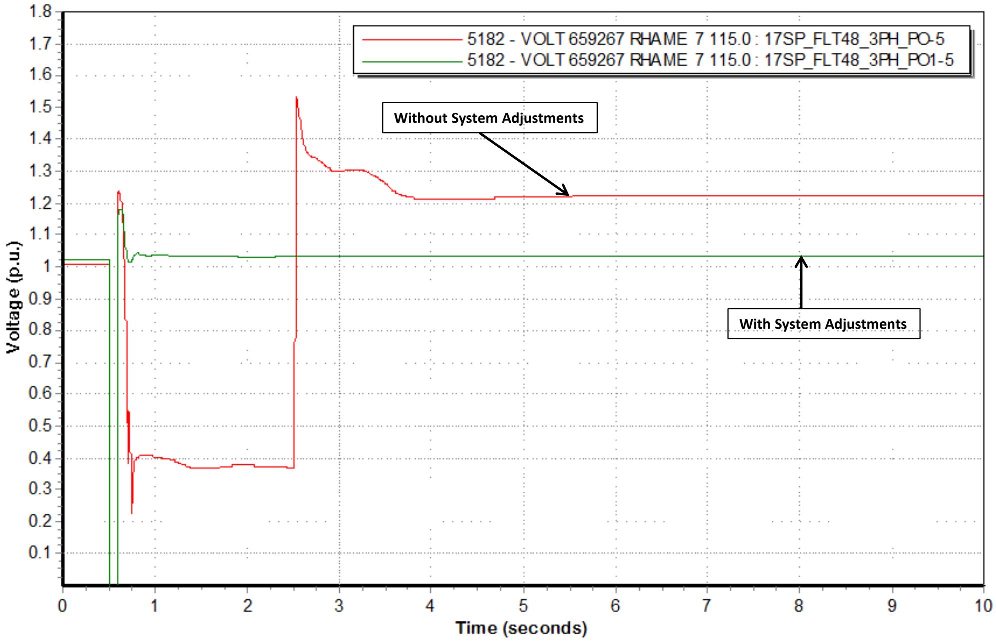

Figure 3-7. Plot of the voltage at RHAME 7 for FLT48-PO for 2017 Summer Peak case with and without system adjustments.

2025 Summer Peak

Voltage violations and generation tripping offline was observed for the 2025 Summer Peak case. One contingency that resulted in voltage violations and generators tripping offline was FLT48-PO. Contingency FLT48-PO had the following four generators tripping offline:

- G15-096-GEN1 (585313) Units 1 and 2
- GI1414GEN W (659453) Units 1 and 2

The following buses were observed to violate SPP Performance Criteria for FLT48-PO:

- RHAME 7
- RHAME 4
- LTLMISS7
- LTLMISS4
- Gl1414 4
- BAKER 4
- HEARTRVR 4

In order to mitigate the voltage violations and generation tripping for this contingency, the curtailment of two units was required:

- G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- GI1414GEN W (Unit 1 reduced by 37.2 MW)

Once the output of both units were reduced, there were no more voltage recovery issues or generators tripping offline.

Refer to Figures 3-8 through 3-10 for stability plots of the violations observed for the 2025 Summer Peak case.

Refer to Appendix B, Appendix C, and Appendix D for a complete set of plots for all contingencies for 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak conditions, respectively.

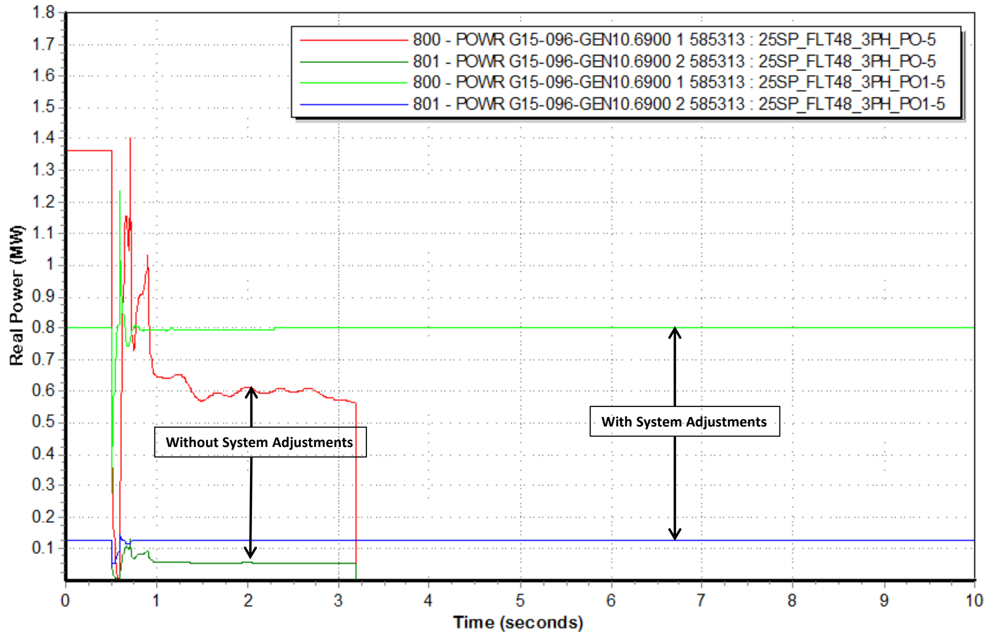

Figure 3-8. Plot of the real power at G15-096-GEN1 for FLT48-PO for 2025 Summer Peak case with and without system adjustments.

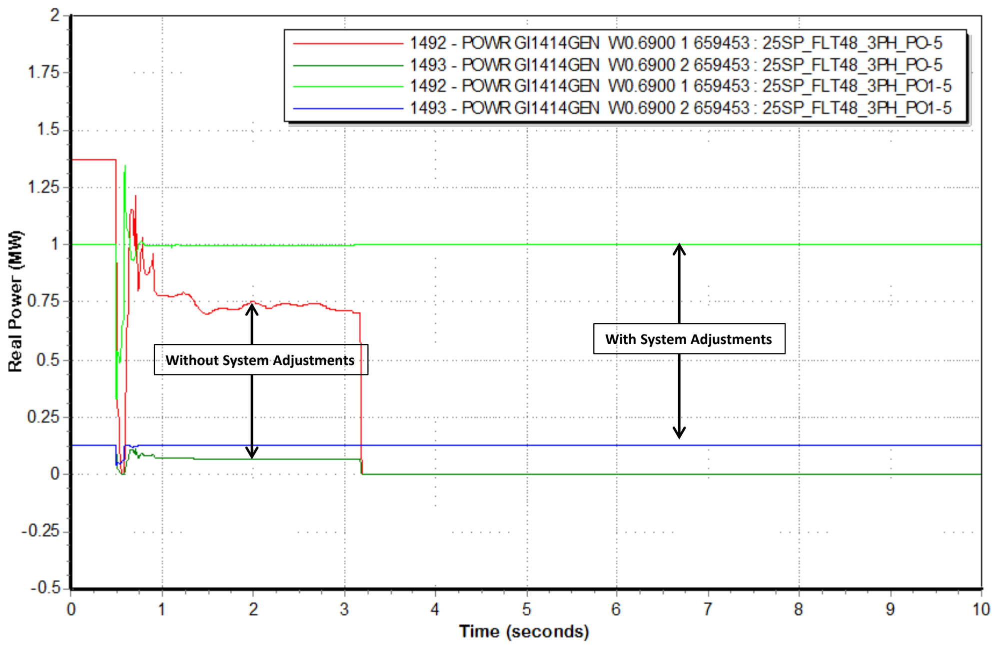

Figure 3-9. Plot of the real power at GI1414GEN for FLT48-PO for 2025 Summer Peak case with and without system adjustments.

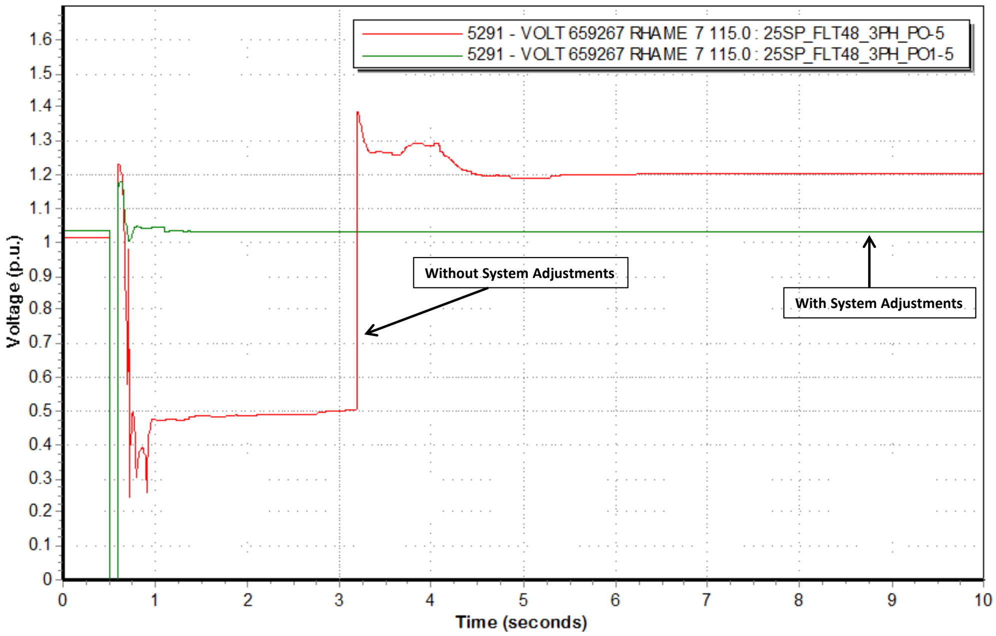

Figure 3-10. Plot of the voltage at RHAME 7 for FLT48-PO for 2025 Summer Peak case with and without system adjustments.

SECTION 4: SHORT-CIRCUIT ANALYSIS

The objective of this task is to quantify the three-phase to ground fault currents for the 2017 and 2025 Summer Peak season for each interconnecting generator.

4.1 Approach

The Short-Circuit analysis will assess breaker adequacy and fault duties for the generator interconnection bus and five buses away from the point of interconnection. MEPPI will assume no outages to find maximum short-circuit currents that flow through the breaker. The Automatic Sequencing Fault Calculation (ASCC) function in PSS/E was utilized to perform this task. FLAT conditions were applied to pre-fault conditions and the following adjustments were utilized:

- All synchronous and asynchronous machine P and Q output was set to zero
- All transformer tap ratios were set to 1.0 p.u. and all phase shift angles were set to zero
- All generator reactance's were fixed to the subtransient reactance
- All line charging was set to zero
- All shunts were set to zero
- All loads were set to zero
- All pre-fault bus voltages were set to 1.0 p.u. and a phase shift angle of zero

4.2 Short-Circuit Results: 2017 Summer Peak

The maximum fault current for each bus is provided for the 2017 Summer Peak conditions. The following tables show the short circuit results for the study generators for the 2017 Summer Peak condition:

- Table 4-1: Short-circuit Analysis for GEN-2015-046
- Table 4-2: Short-circuit Analysis for GEN-2015-096
- Table 4-3: Short-circuit Analysis for GEN-2015-098

Table 4-1
Short-Circuit Analysis for Study Project GEN-2015-046 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
584870	GEN-2015-046	345	4.04
652424	BELFELD3	345	6.27
659101	ANTELOP3	345	15.50
659105	LELANDO3	345	14.63
659183	CHAR.CK3	345	10.04
659212	DGC 3	345	14.80
659218	COTEAU 3	345	15.50
659333	JUDSON 3	345	5.62
659336	TANDE 3	345	4.63
659384	ROUNDUP 3	345	8.31
659387	KUMMERRIDGE3	345	3.36
659390	PATENTGATE 3	345	6.09
659404	ANTELPHILLS3	345	10.89
659420	ANTELOP-LNX3	345	15.50
652216	WATFORD4	230	5.90
652400	WILISTN4	230	7.69
652425	BELFELD4	230	8.65
659108	LOGAN 4	230	4.84
659138	NESET 4	230	7.50
659143	BLAISDELL 4	230	4.65
659302	CHAR.CK4	230	10.84
659334	JUDSON 4	230	7.41
659337	TANDE 4	230	7.21
659362	WHEELOCK 4	230	5.75
659368	TIMBERCREEK4	230	5.81
661084	TIOGA4 4	230	7.50
672602	BDX 4	230	4.02
672603	BDV 4	230	4.31
652391	WILLISTON27	115	13.28
652419	KILDEER7	115	7.64
652421	WILISTN7	115	13.28
652651	FAIRVIEW 7	115	4.81
659139	NESET 7	115	9.16
659144	BLAISDELL 7	115	6.29
659154	LNSMCK4+5GN7	115	9.70

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
659182	CHAR.CK7	115	13.76
659184	R.RIDER7	115	4.32
659185	FOUREYES 7	115	3.58
659348	LONESMCRKGN7	115	4.76
659360	MONT 7	115	9.12
659363	WHEELOCK 7	115	5.21
659385	ROUNDUP 7	115	12.24
659388	KUMMERRIDGE7	115	6.65
659391	PATENTGATE 7	115	11.81
659556	G8 -MK7	115	5.88
659581	DAP -MK7	115	6.26
659582	GALAXYTP-MK7	115	5.85
659586	KEENE -MK7	115	5.39
659592	ALEXANDR-MK7	115	4.83
659599	FNCYBTAP-MK7	115	4.85
659602	PVALLEY -MW7	115	5.23
659609	HESS GAS-MW7	115	8.14
659610	LINDAHLS-MW7	115	4.22
659611	SIMPSON -MW7	115	3.08
659612	NORMANLK-BD7	115	2.52
659622	WESTBANK-MW7	115	4.51
659625	JUDSON MW7	115	11.15
659628	TRENTON -LY7	115	5.05
659630	WHTEARTHTP 7	115	8.72
659635	NWWLLSTN-MW7	115	5.91
659644	TIMBERCK-MK7	115	6.49
659646	F9 -MK7	115	3.80
659648	KEENETAP-MK7	115	5.30
659649	VEEDER -MK7	115	6.02
659653	GRSYBUTTAP 7	115	12.82
659658	INDIANHL-MK7	115	4.81
661012	CLBRTSN7	115	5.93
661080	STANLEY7	115	3.27
661085	TIOGA4 7	115	8.93
661086	TIOGA7 7	115	7.45
661089	LTLMUDY7	115	5.93

Table 4-2
Short-Circuit Analysis for Study Project GEN-2015-096 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
652424	BELFELD3	345	6.27
659101	ANTELOP3	345	15.50
659105	LELANDO3	345	14.63
659183	CHAR.CK3	345	10.04
659212	DGC 3	345	14.80
659218	COTEAU 3	345	15.50
659333	JUDSON 3	345	5.62
659384	ROUNDUP 3	345	8.31
659387	KUMMERRIDGE3	345	3.36
659390	PATENTGATE 3	345	6.09
659404	ANTELPHILLS3	345	10.89
659420	ANTELOP-LNX3	345	15.50
585310	GEN-2015-096	230	2.69
585340	GEN-2015-098	230	3.67
652111	COALHILL4	230	2.22
652216	WATFORD4	230	5.90
652296	WARD 4	230	10.56
652402	MI CTYW4	230	12.95
652403	DAWSONC4	230	3.96
652411	MI CTYE4	230	2.51
652413	MEDORA 4	230	4.90
652417	DICKNSN4	230	6.61
652425	BELFELD4	230	8.65
652468	HEBRON 4	230	5.50
652470	BISON 4	230	2.20
652497	MAURINE4	230	2.23
652616	BEAVERHILL4	230	3.75
657741	MPC02100TAP4	230	15.39
659265	LTLMISS4	230	2.93
659266	RHAME 4	230	3.53
659302	CHAR.CK4	230	10.84
659309	S HEART 4	230	8.65
659400	NDSUNFLWR 4	230	5.04
659448	HEARTRVR 4	230	5.83
659450	GI1414 4	230	3.29
661004	BAKER 4	230	2.80
661010	BOWMAN 4	230	3.04
661042	HESKETT4	230	12.36
661047	HETINGR4	230	2.77
661053	MANDAN 4	230	13.05
661987	G752CLC4	230	2.38
652404	DAWSONC7	115	7.32
652412	MI CTYE7	115	3.78
652418	DKSN-ND7	115	5.92
652419	KILDEER7	115	7.64
659182	CHAR.CK7	115	13.76
659184	R.RIDER7	115	4.32
659185	FOUREYES 7	115	3.58
659263	LTLMISS7	115	1.68
659267	RHAME 7	115	2.86
659306	S HEART 7	115	2.23
659340	BOWMAN 7	115	2.90
659341	NBURR 7	115	1.54
659342	KPS15-BOW7	115	1.04
659350	BISON 7	115	1.17
659385	ROUNDUP 7	115	12.24
659391	PATENTGATE 7	115	11.81
659653	GRSYBUTTAP 7	115	12.82
661005	BAKER 7	115	3.09
661019	MATHSON7	115	5.54
661020	DIXGREENRVR7	115	5.06
661022	DICKNTH7	115	4.73
661024	WDICKSN7	115	4.92
661034	KPS14-BAK7	115	2.87
661048	HETINGR7	115	2.74
661050	GASCOYN7	115	1.55
661054	MANDAN 7	115	16.78
661070	N ENGLN7	115	3.08
652258	BISON 8	69	1.50

Table 4-3
Short-Circuit Analysis for Study Project GEN-2015-098 (17SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
652424	BELFELD3	345	6.27
659101	ANTELOP3	345	15.50
659183	CHAR.CK3	345	10.04
659384	ROUNDUP 3	345	8.31
659390	PATENTGATE 3	345	6.09
585310	GEN-2015-096	230	2.69
585340	GEN-2015-098	230	3.67
652111	COALHILL4	230	2.22
652402	MI CTYW4	230	12.95
652403	DAWSONC4	230	3.96
652405	FTPECK 4	230	2.23
652411	MI CTYE4	230	2.51
652413	MEDORA 4	230	4.90
652417	DICKNSN4	230	6.61
652425	BELFELD4	230	8.65
652450	MT WEST4	230	12.95
652468	HEBRON 4	230	5.50
652616	BEAVERHILL4	230	3.75
659265	LTLMISS4	230	2.93
659266	RHAME 4	230	3.53
659302	CHAR.CK4	230	10.84
659309	S HEART 4	230	8.65
659400	NDSUNFLWR 4	230	5.04
659448	HEARTRVR 4	230	5.83
659450	GI1414 4	230	3.29
661004	BAKER 4	230	2.80
661010	BOWMAN 4	230	3.04
661053	MANDAN 4	230	13.05
652121	KPS12-CR7	115	1.74
652131	KPS13-OF7	115	2.25
652394	TERRY TAP	115	2.79
652395	SHIRLEY TAP	115	2.96
652401	CIRCLE 7	115	1.97
652404	DAWSONC7	115	7.32
652406	FTPECK 7	115	3.52
652407	FALLON 7	115	3.06
652409	WOLFPT 7	115	3.16
652412	MI CTYE7	115	3.78
652418	DKSN-ND7	115	5.92
652451	RICHLND7	115	5.68
652611	KPS10-FP7	115	1.30
652651	FAIRVIEW 7	115	4.81
659180	KOCH 7	115	3.95
659182	CHAR.CK7	115	13.76
659263	LTLMISS7	115	1.68
659267	RHAME 7	115	2.86
659306	S HEART 7	115	2.23
661005	BAKER 7	115	3.09
661019	MATHSON7	115	5.54
661024	WDICKSN7	115	4.92
661032	GLENDCT7	115	5.95
661033	CABINCR7	115	2.85
661034	KPS14-BAK7	115	2.87
661056	LEWIS 7	115	5.77
661070	N ENGLN7	115	3.08
910007	G12_012IST	115	2.11
652213	FALLON 8	69	1.06

4.3 Short-Circuit Results: 2025 Summer Peak

The maximum fault current for each bus is provided for the 2025 Summer Peak conditions. The following tables show the short circuit results for the study generators for the 2025 Summer Peak conditions:

- Table 4-4: Short-circuit Analysis for GEN-2015-046
- Table 4-5: Short-circuit Analysis for GEN-2015-096
- Table 4-6: Short-circuit Analysis for GEN-2015-098

Table 4-4
Short-Circuit Analysis for Study Project GEN-2015-046 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
584870	GEN-2015-046	345	4.17	659184	R.RIDER7	115	4.30
652424	BELFELD3	345	6.40	659185	FOUREYES 7	115	3.58
659101	ANTELOP3	345	16.08	659348	LONESMCRKGN7	115	5.78
659105	LELANDO3	345	15.18	659360	MONT 7	115	10.31
659183	CHAR.CK3	345	10.37	659363	WHEELOCK 7	115	6.15
659212	DGC 3	345	15.33	659373	LARSON 7	115	3.79
659218	COTEAU 3	345	16.08	659385	ROUNDUP 7	115	12.83
659333	JUDSON 3	345	6.38	659388	KUMMERRIDGE7	115	9.85
659336	TANDE 3	345	4.85	659391	PATENTGATE 7	115	12.99
659384	ROUNDUP 3	345	9.29	659556	G8 -MK7	115	6.13
659387	KUMMERRIDGE3	345	6.69	659581	DAP -MK7	115	9.02
659390	PATENTGATE 3	345	7.55	659582	GALAXYTP-MK7	115	8.16
659404	ANTELPHILLS3	345	11.19	659586	KEENE -MK7	115	7.29
659420	ANTELOP-LNX3	345	16.08	659592	ALEXANDR-MK7	115	4.99
652216	WATFORD4	230	6.10	659599	FNCYBTAP-MK7	115	4.99
652400	WILISTN4	230	8.29	659602	PVALLEY -MW7	115	5.23
652425	BELFELD4	230	8.82	659609	HESS GAS-MW7	115	8.23
659108	LOGAN 4	230	4.99	659610	LINDAHLS-MW7	115	4.22
659138	NESET 4	230	7.99	659611	SIMPSON -MW7	115	3.06
659143	BLAISDELL 4	230	4.77	659612	NORMANLK-BD7	115	2.06
659302	CHAR.CK4	230	11.12	659622	WESTBANK-MW7	115	4.51
659334	JUDSON 4	230	7.95	659625	JUDSON MW7	115	11.98
659337	TANDE 4	230	7.65	659628	TRENTON -LY7	115	5.08
659362	WHEELOCK 4	230	6.23	659630	WHTEARTHTP 7	115	8.82
659372	LARSON 4	230	5.35	659635	NWWLLSTN-MW7	115	5.99
661084	TIOGA4 4	230	8.00	659644	TIMBERCK-MK7	115	6.81
672603	BDV 4	230	4.99	659646	F9 -MK7	115	3.88
652391	WILLISTON27	115	14.46	659648	KEENETAP-MK7	115	7.11
652408	WATFORD7	115	7.31	659649	VEEDER -MK7	115	8.52
652419	KILDEER7	115	7.74	659653	GRSYBUTTAP 7	115	13.01
652421	WILISTN7	115	14.46	659658	INDIANHL-MK7	115	4.97
652651	FAIRVIEW 7	115	4.77	661012	CLBRTSN7	115	5.92
659139	NESET 7	115	9.29	661080	STANLEY7	115	3.27
659144	BLAISDELL 7	115	6.35	661085	TIOGA4 7	115	9.02
659154	LNSMCK4+5GN7	115	10.21	661086	TIOGA7 7	115	7.49
659182	CHAR.CK7	115	13.98	661089	LTLMUDY7	115	5.97

Table 4-5
Short-Circuit Analysis for Study Project GEN-2015-096 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
652424	BELFELD3	345	6.40	659450	GI1414 4	230	3.30
659101	ANTELOP3	345	16.08	661004	BAKER 4	230	2.85
659105	LELANDO3	345	15.18	661010	BOWMAN 4	230	3.14
659183	CHAR.CK3	345	10.37	661042	HESKETT4	230	13.42
659212	DGC 3	345	15.33	661047	HETINGR4	230	2.89
659218	COTEAU 3	345	16.08	661053	MANDAN 4	230	14.17
659333	JUDSON 3	345	6.38	661987	G752CLC4	230	2.47
659384	ROUNDUP 3	345	9.29	652404	DAWSONC7	115	7.35
659387	KUMMERRIDGE3	345	6.69	652412	MI CTYE7	115	3.82
659390	PATENTGATE 3	345	7.55	652418	DKSN-ND7	115	5.98
659404	ANTELPHILLS3	345	11.19	652419	KILDEER7	115	7.74
659420	ANTELOP-LNX3	345	16.08	659182	CHAR.CK7	115	13.98
585310	GEN-2015-096	230	2.70	659184	R.RIDER7	115	4.30
585340	GEN-2015-098	230	3.70	659185	FOUREYES 7	115	3.58
652111	COALHILL4	230	2.24	659263	LTLMISS7	115	1.70
652216	WATFORD4	230	6.10	659267	RHAME 7	115	2.91
652296	WARD 4	230	11.21	659306	S HEART 7	115	2.24
652402	MI CTYW4	230	12.98	659340	BOWMAN 7	115	2.93
652403	DAWSONC4	230	4.00	659341	NBURR 7	115	1.57
652411	MI CTYE4	230	2.55	659342	KPS15-BOW7	115	1.07
652413	MEDORA 4	230	4.95	659350	BISON 7	115	1.22
652417	DICKNSN4	230	6.73	659385	ROUNDUP 7	115	12.83
652425	BELFELD4	230	8.82	659391	PATENTGATE 7	115	12.99
652468	HEBRON 4	230	5.61	659653	GRSYBUTTAP 7	115	13.01
652470	BISON 4	230	2.34	661005	BAKER 7	115	3.13
652497	MAURINE4	230	2.38	661019	MATHSON7	115	5.59
652616	BEAVERHILL4	230	3.78	661020	DIXGREENRVR7	115	5.09
657741	MPC02100TAP4	230	15.86	661022	DICKNTH7	115	4.78
659265	LTLMISS4	230	2.99	661024	WDICKSN7	115	4.97
659266	RHAME 4	230	3.62	661034	KPS14-BAK7	115	2.91
659302	CHAR.CK4	230	11.12	661048	HETINGR7	115	2.81
659309	S HEART 4	230	8.82	661050	GASCOYN7	115	1.59
659400	NDSUNFLWR 4	230	5.13	661054	MANDAN 7	115	19.48
659448	HEARTRVR 4	230	5.92	661070	N ENGLN7	115	3.13
				652258	BISON 8	69	1.58

Table 4-6
Short-Circuit Analysis for Study Project GEN-2015-098 (25SP)

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
652424	BELFELD3	345	6.40	652121	KPS12-CR7	115	1.77
659101	ANTELOP3	345	16.08	652131	KPS13-OF7	115	2.27
659183	CHAR.CK3	345	10.37	652394	TERRY TAP	115	2.81
659384	ROUNDUP 3	345	9.29	652395	SHIRLEY TAP	115	2.97
659390	PATENTGATE 3	345	7.55	652401	CIRCLE 7	115	2.00
585310	GEN-2015-096	230	2.70	652404	DAWSONC7	115	7.35
585340	GEN-2015-098	230	3.70	652406	FTPECK 7	115	3.57
652111	COALHILL4	230	2.24	652407	FALLON 7	115	3.09
652402	MI CTYW4	230	12.98	652409	WOLFPT 7	115	3.19
652403	DAWSONC4	230	4.00	652412	MI CTYE7	115	3.82
652405	FTPECK 4	230	2.25	652418	DKSN-ND7	115	5.98
652411	MI CTYE4	230	2.55	652451	RICHLND7	115	5.68
652413	MEDORA 4	230	4.95	652611	KPS10-FP7	115	1.31
652417	DICKNSN4	230	6.73	652651	FAIRVIEW 7	115	4.77
652425	BELFELD4	230	8.82	659180	KOCH 7	115	3.93
652450	MT WEST4	230	12.98	659182	CHAR.CK7	115	13.98
652468	HEBRON 4	230	5.61	659263	LTLMISS7	115	1.70
652616	BEAVERHILL4	230	3.78	659267	RHAME 7	115	2.91
659265	LTLMISS4	230	2.99	659306	S HEART 7	115	2.24
659266	RHAME 4	230	3.62	661005	BAKER 7	115	3.13
659302	CHAR.CK4	230	11.12	661019	MATHSON7	115	5.59
659309	S HEART 4	230	8.82	661024	WDICKSN7	115	4.97
659400	NDSUNFLWR 4	230	5.13	661032	GLENDCT7	115	5.98
659448	HEARTRVR 4	230	5.92	661033	CABINCR7	115	2.88
659450	GI1414 4	230	3.30	661034	KPS14-BAK7	115	2.91
661004	BAKER 4	230	2.85	661056	LEWIS 7	115	5.76
661010	BOWMAN 4	230	3.14	661070	N ENGLN7	115	3.13
661053	MANDAN 4	230	14.17	910007	G12_012IST	115	2.13
				652213	FALLON 8	69	1.05

SECTION 5: POWER FACTOR ANALYSIS

The objective of this task is to quantify the power factor at the point of interconnection for the wind farms during base case and system contingencies. SPP transmission planning practice requires interconnecting generation projects to maintain the power factor (pf) at the Point of Interconnection (POI) within +/- 0.95 pf for system intact conditions and for post-contingency conditions. This is analyzed by having the wind/solar farm maintain a prescribed voltage schedule at the point of interconnection of 1.0 p.u. voltage or higher.

The 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak power flows provided by SPP were examined prior to the Power Factor Analysis to ensure they contained the proposed study project modeled at 100% of the nameplate rating and any previously queued projects listed in Table 2-2. There was no suspect power flow data in the study area. The proposed study project and any previously queued projects at the same point of interconnection were turned off during the power factor analysis. The wind farm(s) were then replaced by a generator modeled at the high side bus with the same real power (MW) capability as the wind farm(s) and open limits for the reactive power set points (Mvar). The generator was set to hold the POI scheduled bus voltage. All N-1, three-phase fault contingencies from Table 2-3 were then applied and the reactive power required to maintain the bus voltage was recorded.

5.1 Approach

Refer to Section 3 for the necessary upgrades and Table 5-1 for the scheduled voltage each study generator was set to hold at the point of interconnection for each season.

GEN-2015-046 (584873) was disabled in the power flow case. A generator was placed at the high side bus of GEN-2015-046 and modeled with PGEN = 300 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the high side bus of each project to the corresponding generator were disabled.

GEN-2015-096 (585313) has two generating units tapped off of the point of interconnection, Heart River 230 kV, and both were disabled in the power flow case. GI1414 (659453) is also tapped off of the Heart River 230 kV point of interconnection and both units were also disabled. One equivalent generator was placed at the high side bus of GEN-2015-096 and modeled with PGEN = 300 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the high side bus of each project to the corresponding generator were disabled.

GEN-2015-098 (585343) was disabled and a generator was placed at the study project's high side bus. The generator was modeled with PGEN = 100 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high side bus to GEN-2015-098 were disabled.

Table 5-1
Voltage Schedule of All Study Generators for All Seasons

Point of Interconnection Voltage (p.u.)				
Request	**POI**	**16WP**	**17SP**	**25SP**
GEN-2015-046	Tandee (Neset) 345 kV (659336)	1.036	1.030	1.028
GEN-2015-096	HEARTRR 230 kV (659448)	1.014	1.022	1.005
GEN-2015-098	Beaverhill 230 kV (652616)	1.023	1.015	1.019

5.2 Power Factor Analysis Results

The power factor was calculated for the 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak conditions. The following tables show the power factor results for the study generators:

- Table 5-2: Power Factor Analysis for GEN-2015-046
- Table 5-3: Power Factor Analysis for GEN-2015-096
- Table 5-4: Power Factor Analysis for GEN-2015-098

Note that a positive Q (Mvar) output illustrates that the generator is absorbing reactive power from the system, implying a leading power factor; a negative Q (Mvar) illustrates that the generator is supplying reactive power to the system, implying a lagging power factor.

Table 5-2
Power Factor Analysis: GEN-2015-046

Cont. No.	Case	2016 Winter Peak			2017 Summer Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.998	Leading	19.131	0.998	Lagging	-17.663	0.984	Leading	18.047
1	FLT01-3PH	0.997	Lagging	-24.507	0.998	Lagging	-21.182	0.987	Leading	16.429
2	FLT02-3PH	0.999	Leading	14.380	0.998	Lagging	-21.158	0.986	Leading	16.848
3	FLT03-3PH	0.999	Leading	11.989	0.998	Lagging	-20.176	0.986	Leading	17.023
4	FLT04-3PH	0.996	Leading	27.928	0.999	Lagging	-13.600	0.981	Leading	19.635
5	FLT05-3PH	0.997	Leading	23.146	0.998	Lagging	-16.715	0.983	Leading	18.543
6	FLT06-3PH	0.998	Leading	19.131	0.998	Lagging	-17.663	0.984	Leading	18.047
7	FLT07-3PH	0.998	Leading	17.100	0.998	Lagging	-17.572	0.984	Leading	17.903
8	FLT08-3PH	0.998	Leading	16.555	0.998	Lagging	-18.957	0.985	Leading	17.312
9	FLT09-3PH	0.998	Leading	17.504	0.997	Lagging	-22.351	0.996	Leading	9.455
10	FLT10-3PH	0.998	Leading	19.166	0.998	Lagging	-17.928	0.984	Leading	18.007
11	FLT11-3PH	0.998	Leading	19.071	0.998	Lagging	-17.674	0.984	Leading	18.052
12	FLT12-3PH	0.999	Leading	14.323	0.998	Lagging	-21.183	0.986	Leading	16.836
13	FLT13-3PH	0.999	Leading	12.414	0.998	Lagging	-19.245	0.986	Leading	17.024
14	FLT14-3PH	0.998	Leading	18.875	0.998	Lagging	-17.683	0.984	Leading	18.054
15	FLT15-3PH	0.998	Leading	18.095	0.998	Lagging	-17.721	0.984	Leading	18.051
16	FLT16-3PH	0.998	Leading	17.629	0.998	Lagging	-17.899	0.984	Leading	17.951
17	FLT17-3PH	0.998	Leading	19.482	0.998	Lagging	-18.304	0.986	Leading	17.081
18	FLT18-3PH	0.997	Leading	21.515	0.986	Lagging	-51.625	0.969	Leading	25.351
19	FLT19-3PH	0.999	Leading	15.779	0.995	Lagging	-31.508	1.000	Lagging	-0.165
20	FLT20-3PH	0.999	Leading	13.813	0.998	Lagging	-17.652	0.986	Leading	17.076
21	FLT21-3PH	0.998	Leading	18.403	0.998	Lagging	-19.091	0.965	Leading	26.990
22	FLT22-3PH	0.998	Leading	19.131	0.998	Lagging	-17.663	0.984	Leading	18.047
23	FLT23-3PH	0.999	Leading	16.360	0.999	Lagging	-11.523	0.982	Leading	19.072
24	FLT24-3PH	0.998	Leading	20.062	0.996	Lagging	-25.295	0.996	Leading	8.704
25	FLT25-3PH	0.998	Leading	19.131	0.998	Lagging	-17.663	0.984	Leading	18.047
26	FLT26-3PH	0.998	Leading	19.276	0.997	Lagging	-21.938	0.994	Leading	11.159
27	FLT27-3PH	0.998	Leading	19.529	0.999	Lagging	-10.543	0.984	Leading	18.229
28	FLT28-3PH	0.998	Leading	19.131	0.998	Lagging	-17.663	0.984	Leading	18.047
29	FLT29-3PH	0.998	Leading	18.713	0.999	Lagging	-10.157	0.982	Leading	18.967
30	FLT30-3PH	0.999	Leading	13.526	0.997	Lagging	-24.558	0.988	Leading	15.578
31	FLT31-3PH	0.998	Leading	17.820	0.998	Lagging	-17.896	0.979	Leading	20.579
32	FLT32-3PH	0.998	Leading	19.498	0.995	Lagging	-31.128	0.993	Leading	12.197
33	FLT33-3PH	0.999	Leading	14.204	0.984	Lagging	-53.868	0.999	Lagging	-4.777
34	FLT34-3PH	0.999	Leading	12.562	0.997	Lagging	-23.490	1.000	Leading	0.072
35	FLT35-3PH	0.998	Leading	19.222	0.998	Lagging	-16.875	0.967	Leading	26.202
36	FLT36-3PH	0.999	Leading	11.945	0.998	Lagging	-21.111	0.994	Leading	10.620
37	FLT37-3PH	0.998	Leading	18.803	0.998	Lagging	-17.686	0.983	Leading	18.700
38	FLT38-3PH	0.998	Leading	18.601	0.998	Lagging	-19.619	0.987	Leading	16.004
39	FLT39-3PH	0.998	Leading	17.870	0.998	Lagging	-17.045	0.979	Leading	20.987
40	FLT40-3PH	0.998	Leading	19.090	0.998	Lagging	-17.830	0.987	Leading	16.269

Study Generator GEN-2015-046

The Power Factor Analysis shows that GEN-2015-046 has a power factor range of 0.996 leading (absorbing) to 0.999 leading (absorbing) for the 2016 Winter Peak conditions, a power factor range of 0.984 lagging (supplying) to 0.999 lagging (supplying) for the 2017 Summer Peak conditions, and a power factor range of 0.965 leading (absorbing) to 0.999 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-3
Power Factor Analysis: GEN-2015-096

Cont. No.	Case	2016 Winter Peak Power Factor		2016 Winter Peak Q (MVAR)	2017 Summer Peak Power Factor		2017 Summer Peak Q (MVAR)	2025 Summer Peak Power Factor		2025 Summer Peak Q (MVAR)
0	Base	0.999	Lagging	-16.384	0.999	Leading	16.366	0.980	Leading	20.077
1	FLT01-3PH	0.981	Lagging	-58.524	0.998	Leading	17.586	0.981	Leading	19.648
2	FLT02-3PH	1.000	Leading	6.505	0.999	Leading	16.034	0.980	Leading	20.154
3	FLT03-3PH	0.998	Lagging	-16.503	0.999	Leading	10.875	0.988	Leading	15.357
4	FLT04-3PH	0.999	Lagging	-12.942	0.997	Leading	22.338	0.976	Leading	22.429
5	FLT05-3PH	0.999	Lagging	-13.260	0.998	Leading	16.756	0.981	Leading	19.813
6	FLT06-3PH	0.999	Lagging	-13.341	0.999	Leading	13.613	0.983	Leading	18.608
7	FLT07-3PH	0.997	Lagging	-22.171	0.999	Leading	12.681	0.983	Leading	18.784
8	FLT08-3PH	0.998	Lagging	-19.347	0.999	Leading	10.809	0.985	Leading	17.788
9	FLT09-3PH	0.998	Lagging	-16.467	1.000	Leading	1.870	0.995	Leading	9.556
10	FLT10-3PH	0.998	Lagging	-16.645	0.999	Leading	16.343	0.981	Leading	19.950
11	FLT11-3PH	0.999	Lagging	-16.190	0.999	Leading	16.334	0.980	Leading	20.071
12	FLT12-3PH	1.000	Leading	6.441	0.998	Leading	16.460	0.980	Leading	20.121
13	FLT13-3PH	0.997	Lagging	-22.708	0.999	Leading	16.420	0.980	Leading	20.246
14	FLT14-3PH	0.998	Lagging	-18.837	0.999	Leading	16.420	0.980	Leading	20.169
15	FLT15-3PH	0.998	Lagging	-18.635	0.999	Leading	16.264	0.980	Leading	20.083
16	FLT16-3PH	0.997	Lagging	-23.434	0.999	Leading	12.413	0.985	Leading	17.635
17	FLT17-3PH	0.999	Lagging	-16.085	0.999	Leading	14.015	0.983	Leading	18.868
18	FLT18-3PH	0.999	Lagging	-15.193	0.991	Lagging	-40.716	0.974	Leading	23.174
19	FLT19-3PH	0.998	Lagging	-17.026	1.000	Lagging	-2.784	0.999	Leading	4.185
20	FLT20-3PH	0.998	Lagging	-20.248	0.999	Leading	12.028	0.982	Leading	19.439
21	FLT21-3PH	0.998	Lagging	-18.433	0.999	Leading	11.731	0.971	Leading	24.629
22	FLT22-3PH	0.999	Lagging	-16.384	0.999	Leading	16.366	0.980	Leading	20.077
23	FLT23-3PH	0.997	Lagging	-24.718	0.996	Lagging	-26.160	0.996	Lagging	-27.971
24	FLT24-3PH	0.998	Lagging	-16.506	1.000	Leading	1.777	0.987	Leading	16.188
25	FLT25-3PH	0.999	Lagging	-16.384	0.999	Leading	16.366	0.980	Leading	20.077
26	FLT26-3PH	0.999	Lagging	-16.443	0.999	Leading	10.902	0.991	Leading	13.340
27	FLT27-3PH	0.998	Lagging	-16.525	0.998	Leading	19.395	0.985	Leading	17.693
28	FLT28-3PH	0.999	Lagging	-16.384	0.999	Leading	16.366	0.980	Leading	20.077
29	FLT29-3PH	0.998	Lagging	-18.620	0.995	Leading	31.531	0.974	Leading	23.457
30	FLT30-3PH	0.997	Lagging	-23.108	1.000	Leading	7.664	0.981	Leading	19.860
31	FLT31-3PH	0.998	Lagging	-19.119	0.999	Leading	12.305	0.987	Leading	16.563
32	FLT32-3PH	0.999	Lagging	-15.297	1.000	Leading	5.007	0.998	Leading	6.495
33	FLT33-3PH	0.998	Leading	18.095	0.997	Lagging	-21.260	1.000	Leading	2.802
34	FLT34-3PH	0.997	Lagging	-24.995	0.999	Leading	15.248	0.996	Leading	9.462
35	FLT35-3PH	0.998	Lagging	-16.555	0.998	Leading	16.640	0.979	Leading	20.615
36	FLT36-3PH	0.996	Lagging	-25.505	0.998	Leading	17.448	0.974	Leading	23.341
37	FLT37-3PH	0.998	Lagging	-18.103	0.999	Leading	15.946	0.980	Leading	20.475
38	FLT38-3PH	0.998	Lagging	-17.386	0.999	Leading	12.429	0.990	Leading	14.189
39	FLT39-3PH	0.998	Lagging	-19.088	0.998	Leading	16.542	0.978	Leading	21.553
40	FLT40-3PH	0.999	Lagging	-16.377	0.998	Leading	17.673	0.991	Leading	13.498

Study Generator GEN-2015-096

The Power Factor Analysis shows that GEN-2015-096 has a power factor range of 0.998 leading (absorbing) to 0.981 lagging (supplying) for the 2016 Winter Peak conditions, a power factor range of 0.995 leading (absorbing) to 0.991 lagging (supplying) for the 2017 Summer Peak conditions, and a power factor range of 0.971 leading (absorbing) to 0.996 lagging (supplying) for the 2025 Summer Peak conditions.

Table 5-4
Power Factor Analysis: GEN-2015-098

Cont. No.	Case	2016 Winter Peak			2017 Summer Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.999	Lagging	-15.856	0.998	Leading	20.643	0.975	Leading	22.624
1	FLT01-3PH	0.989	Lagging	-43.929	0.998	Leading	17.819	0.978	Leading	21.208
2	FLT02-3PH	1.000	Lagging	-0.385	0.998	Leading	16.768	0.978	Leading	21.388
3	FLT03-3PH	0.999	Lagging	-13.905	0.998	Leading	18.208	0.978	Leading	21.380
4	FLT04-3PH	1.000	Lagging	-7.450	0.997	Leading	24.091	0.972	Leading	24.071
5	FLT05-3PH	0.999	Lagging	-10.373	0.997	Leading	21.472	0.975	Leading	23.002
6	FLT06-3PH	0.998	Lagging	-17.203	0.998	Leading	18.641	0.977	Leading	21.850
7	FLT07-3PH	0.998	Lagging	-19.449	0.998	Leading	18.815	0.977	Leading	22.030
8	FLT08-3PH	0.998	Lagging	-18.361	0.998	Leading	18.753	0.977	Leading	21.887
9	FLT09-3PH	0.998	Lagging	-19.005	1.000	Leading	5.399	0.992	Leading	12.972
10	FLT10-3PH	0.999	Lagging	-15.806	0.998	Leading	20.594	0.975	Leading	22.611
11	FLT11-3PH	0.999	Lagging	-15.301	0.998	Leading	20.631	0.975	Leading	22.624
12	FLT12-3PH	1.000	Lagging	-0.433	0.998	Leading	16.746	0.978	Leading	21.377
13	FLT13-3PH	0.994	Lagging	-33.170	0.998	Leading	17.612	0.979	Leading	20.799
14	FLT14-3PH	0.999	Lagging	-15.483	0.998	Leading	20.631	0.975	Leading	22.628
15	FLT15-3PH	0.998	Lagging	-16.943	0.998	Leading	20.562	0.975	Leading	22.613
16	FLT16-3PH	0.998	Lagging	-17.941	0.998	Leading	20.063	0.976	Leading	22.321
17	FLT17-3PH	0.999	Lagging	-15.603	0.998	Leading	18.287	0.978	Leading	21.538
18	FLT18-3PH	0.999	Lagging	-12.920	0.990	Lagging	-41.918	0.959	Leading	29.559
19	FLT19-3PH	0.998	Lagging	-20.170	1.000	Lagging	-3.234	0.997	Lagging	-8.100
20	FLT20-3PH	0.997	Lagging	-21.969	0.999	Leading	15.215	0.978	Leading	21.402
21	FLT21-3PH	0.999	Lagging	-16.315	0.999	Leading	12.987	0.966	Leading	26.610
22	FLT22-3PH	0.999	Lagging	-15.856	0.998	Leading	20.643	0.975	Leading	22.624
23	FLT23-3PH	0.998	Lagging	-20.232	0.996	Leading	27.971	0.970	Leading	25.204
24	FLT24-3PH	0.999	Lagging	-15.398	1.000	Leading	5.621	0.994	Leading	11.331
25	FLT25-3PH	0.999	Lagging	-15.856	0.998	Leading	20.643	0.975	Leading	22.624
26	FLT26-3PH	0.999	Lagging	-15.831	0.999	Leading	13.722	0.988	Leading	15.309
27	FLT27-3PH	0.999	Lagging	-15.669	0.997	Leading	24.724	0.980	Leading	20.293
28	FLT28-3PH	0.999	Lagging	-15.856	0.998	Leading	20.643	0.975	Leading	22.624
29	FLT29-3PH	0.998	Lagging	-17.482	0.996	Leading	27.398	0.971	Leading	24.722
30	FLT30-3PH	0.998	Lagging	-21.171	0.999	Leading	14.870	0.979	Leading	21.059
31	FLT31-3PH	0.998	Lagging	-17.083	0.999	Leading	13.792	0.974	Leading	23.064
32	FLT32-3PH	0.999	Lagging	-15.679	1.000	Leading	1.104	0.999	Leading	3.822
33	FLT33-3PH	0.997	Lagging	-21.346	0.996	Lagging	-27.124	0.999	Lagging	-5.012
34	FLT34-3PH	0.997	Lagging	-22.216	0.999	Leading	15.231	1.000	Leading	0.720
35	FLT35-3PH	0.999	Lagging	-15.632	0.998	Leading	20.763	0.966	Leading	26.782
36	FLT36-3PH	0.997	Lagging	-23.306	0.999	Leading	14.056	0.997	Leading	7.914
37	FLT37-3PH	0.998	Lagging	-16.752	0.998	Leading	20.434	0.972	Leading	24.091
38	FLT38-3PH	0.998	Lagging	-16.618	0.998	Leading	17.146	0.980	Leading	20.076
39	FLT39-3PH	0.998	Lagging	-17.174	0.998	Leading	20.996	0.969	Leading	25.501
40	FLT40-3PH	0.999	Lagging	-16.067	0.998	Leading	20.215	0.978	Leading	21.548

Study Generator GEN-2015-098

The Power Factor Analysis shows that GEN-2015-098 has a power factor range of 0.989 lagging (supplying) to unity for the 2016 Winter Peak conditions, a power factor range of 0.996 leading (absorbing) to 0.996 lagging (supplying) for the 2017 Summer Peak conditions, and a power factor range of 0.959 leading (absorbing) to 0.997 lagging (supplying) for the 2025 Summer Peak conditions.

SECTION 6: LOW/NO WIND ANALYSIS

The objective of this task is to determine the impact of low/no wind conditions on wind farms. The 2016 Winter Peak, 2017 Summer Peak, and 2025 Summer Peak power flows provided by SPP were examined for this analysis.

6.1 Approach

Low/no wind conditions were examined for all wind farms. Generators were disabled (independently), but the collector systems remained in-service. The amount of reactive power injected into the transmission network was recorded at the respective point of interconnection. This reactive power comes from the capacitance of the project's transmission lines and collector cables. A shunt reactor was added at the high side bus to bring the Mvar flow into the POI down to approximately zero.

6.2 Low/No Wind Analysis

The reactance needed to bring the Mvar flow into the point of interconnect to zero Mvar was recorded for each season for all wind or solar farms. Refer to Table 6-1 for the Low/No Wind Analysis results. The table lists the generators examined and the amount of reactive power needed for zero Mvar flow into the POI for each season.

Table 6-1
Low/No Wind/Solar Irradiance Analysis Results

Request	Size (MW)	POI Name	2016 WP	2017 SP	2025 SP
GEN-2015-046	300	Tandee (Neset) 345 kV (659336)	-40.00	-40.00	-40.00
GEN-2015-096	150	HEARTRVR 230 kV (659448)	-16.90	-16.90	-16.90
GEN-2015-098	100	Beaverhill 230 kV (652616)	-9.98	-9.98	-9.98

SECTION 7: CONCLUSIONS

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined there were multiple contingencies that resulted in voltage instability and high post-fault voltage recovery when all generation interconnection requests were at 100% output.

2016 Winter Peak

FLT48-PO was observed to have generators swinging offline and voltage instability. In order to mitigate these observed violations, the following recommended mitigation measures were provided by SPP:

- Curtailment of G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- Curtailment of GI1414GEN W (Unit 1 reduced by 37.2 MW)

Similarly, FLT33-3PH, FLT34-3PH, and FLT35-3PH were observed to have bus voltages transiently recover above 1.2 p.u. after the fault was cleared. However, the voltage recovery for all three faults were determined to be prior existing conditions. It is recommended that the Transmission Owner investigate this issue further.

2017 Summer Peak

FLT48-PO was observed to have both undervoltage and overvoltage violations. It was determined that curtailing the following two units mitigated the voltage violations observed:

- G15-096-GEN1 (Unit 1 reduced by 66.5 MW)
- GI1414GEN W (Unit 1 reduced by 37.2 MW)

2025 Summer Peak

FLT48-PO was observed to have undervoltage violations, overvoltage violations, post-contingency final voltages greater than 1.1 p.u., and also generation tripping offline. It was determined that the following units should be curtailed to mitigate the voltage violations:

- Curtailment of G15-096-GEN1 (Unit 1 reduced by 56.5 MW)
- Curtailment of GI1414GEN W (Unit 1 reduced by 37.2 MW)

After applying the above mitigation for all study years, generation tripping offline, voltage violations, and voltage instability for all contingencies were mitigated. Generation curtailment is required for all study years in order to maintain the steady-state voltage within acceptable limits for FLT48-PO.

SUMMARY OF THE SHORT-CIRCUIT ANALYSIS

The Short-Circuit Analysis was performed on the 2017 Summer Peak and 2025 Summer Peak power flows for all study projects. Refer to Table 7-1 for a list of maximum fault currents observed for each study project for the 2017 Summer Peak case. Refer to Table 7-2 for a list of maximum fault currents observed for each study project for the 2025 Summer Peak case.

Table 7-1
List of Maximum Fault Currents Observed for Each Study Project for the 2017 Summer Peak Case

Study Project	POI Name	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-046	Tandee (Neset) 345 kV (659336)	4.63	15.50	ANTELOP-LNX3	345
GEN-2015-096	HEARTRVR 230 kV (659448)	5.83	16.78	MANDAN 7	115
GEN-2015-098	Beaverhill 230 kV (652616)	3.75	15.50	ANTELOP3	345

Table 7-2
List of Maximum Fault Currents Observed for Each Study Project for the 2025 Summer Peak Case

Study Project	POI Name	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-046	Tandee (Neset) 345 kV (659336)	4.85	16.08	ANTELOP3	345
GEN-2015-096	HEARTRVR 230 kV (659448)	5.92	19.48	MANDAN 7	115
GEN-2015-098	Beaverhill 230 kV (652616)	3.78	16.08	ANTELOP3	345

SUMMARY OF POWER FACTOR ANALYSIS

Refer to Table 7-3 for the power factor analysis results for each study generator. The table lists the range of power factor required for each study project.

Table 7-3
Power Factor Analysis Summary for Study Projects

Study Project	Power Factor Range for Each Study Project[1]					
	16WP		17SP		25SP	
GEN-2015-046	0.996	0.999	-0.984	-0.999	0.965	-0.999
GEN-2015-096	0.998	-0.981	0.995	-0.991	0.971	-0.996
GEN-2015-098	-0.989	1.000	0.996	-0.996	0.959	-0.997

[1]Lagging power factors are negative and leading power factors are positive

SUMMARY OF THE LOW/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the high side of the transformer near the point of interconnection for all study projects for each season. The maximum reactance needed for zero Mvar flow was -40 Mvar for GEN-2015-046. The minimum reactance needed for zero Mvar flow was -9.98 Mvar for GEN-2015-098.